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## *ORIGINAL ARTICLES*

### ABNORMALITIES OF THE TEETH AND JAWS DUE TO THE LACK OF FUNCTION OF THE DUCTLESS GLANDS*

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THE report and history of a number of cases of jaw deformities with mental disturbance is found in psychiatrical as well as in odontological literature, and until now their genetic cause was hypothetical, but further examination has brought to light some reliable facts.

The etiology of mental disease in single cases is very obscure; we have also very little knowledge of the etiology of jaw deformities.

A new light has been thrown on all these questions by the theory of internal secretion, which has proved very useful to dentists as well as to psychiatrists. In odontology, researches in anomalies of the teeth and jaws show that the theory of internal secretion in relation to psychical defects must not be disregarded.

A new realm of research lies before us. I beg to give you a short account of my experiences in this field. At the same time I shall try to point out the method I followed. First of all I shall make some general remarks about the facts contained in psychiatrical literature concerning the glands of internal secretion as an etiologic factor. No scientific data have yet been discovered, but this much might be said:—

In childhood, insanity is accompanied by a pluriglandular disturbance, and those most in evidence are the sexual glands, together with the thyroid gland and paranephros. The same disturbances are considered by several scientists as the cause of epilepsy, especially during the attack itself.

*Presented at a meeting of the European Orthodontological Society, Amsterdam, August, 1924.

The thyroid gland is responsible for infantilism and imbecility; the ovaries and pituitary gland are often held responsible in pluriglandular complexes.

In the cases of more severe diseases of the glands themselves, it has been stated that psychoses can only be considered as accidental. Other diseases attributed to this cause are exophthalmic goitre, acromegaly, myxœdema, eunuchoidism, dystrophia adiposo-genitalis. With exophthalmic goitre and acromegaly, maniacal-depressive psychoses will be combined. With myxœdema dementia, præcox or simple, with dystrophia, adiposo-genitalis will be combined with insanity.

Regarding other psychical defects, no clear idea has hitherto been gained as to their connection with internal secretion.

Looking at the special forms in which the jaw and teeth deformities occur with the single diseases, it may be said that a certain group has already produced distinct varieties. The extreme degree of this group is idiocy and cretinism.

One has many proofs of the connection of idiocy and cretinism with abnormalities of the masticatory apparatus. It is of course impossible to go into details of the different theses; I shall only mention the generally observed deformities.

The following are the single symptoms as regards:—

(*a*) *The Teeth.*—Irregular growth, consisting of retardation of eruption, complete retention, aberration, torsion of the axes, gemmination, hypertrophy or hypotrophy in the mass, complete absence of single teeth, or whole groups of them, supernumerary teeth and displacement of the germ.

(*b*) *The Jaws.*—Typical forms, as for instance prognathism of the upper jaw, prognathism of the lower jaw, or of both, degenerating in the extreme to animal forms; upper jaw v-shaped, lower jaw v-shaped, high palate ending in a sharp arch, narrowing of the upper jaw, open bite, close bite.

Generally speaking the same anomalies of the teeth and jaws will be found in persons with mental disease as well as in the mentally sound, but the percentage will be higher in the former. It has been proposed to study these questions in as many lunatic asylums as possible to get a proper idea of the state of things in this respect. But I do not believe that in this direction anything specially new will be found.

First of all the investigator should state the typical deformities of the masticating apparatus found in patients with various psychical forms of diseases. Secondly a research should be made into the cause of them.

Some studies have already been made in this respect. All scientists agree that the deformities are disturbances of growth resulting from the glands of internal secretion. They have already tried to explain the connection of the growth of the jaws with the particular glands by hypotheses, as for instance:—

The disturbance of the function of the parathyroid brings about tetany; the special cause is supposed to be lack of calcification, which in the teeth would produce hypoplasia.

A defect of the ovaries or the testicles may produce retardation of assimilation. The lower jaw of castrates will show excessive growth.

Nothing is known at present about the relation of the ovaries to the jaws, but I believe that even here important influences will be found. I shall explain this later on.

Thirdly, the function of the genitals are somehow connected with the paranephros. The application of an extract of paranephros is very successful in cases of disturbances of dentition and even of teething fever.

Furthermore, great attention has been paid to the hypophysis. The typical form of disease is acromegaly, excessive growth of the lower jaw, rarely the upper jaw.

But the chief interest rests with the thyroid gland. Idiocy and cretinism belong to these forms of diseases. In the masticatory apparatus alveolar prognathism, protrusion of the frontal part of the upper and sometimes of the lower jaw and teeth were observed; in short, all the above-mentioned cases of deformities of the jaws.

It has been stated that the blood glands are in very intimate connection, thus for instance: the disturbance of a distinct gland will often cause a disease, which may also occur when another gland is in abnormal function, for instance acromegaly (disturbance of the hypophysis) can be found again in castrates as hyperplasia of the lower jaw. The explanation for this would be that all blood glands are in very intimate connection with each other. The secretion of one of them has a certain effect on the others, which are in functional relation with them. If there occurs a disturbance of one of them, the function of the others must be affected somehow. The disturbance of function also bears upon the other tissues of the organism in various ways. To this sort of disturbance belongs the so-called defections as observed with females during the menopause, in the form of congestion, or diseases of the central nervous system (e.g., convulsions) or the alteration of the trophoneurotical balance, to which the alterations of growth would belong. Whether all this would be caused by irritation of the central nervous system only, I will not decide. Our chief interest will be the alterations in the growth of the teeth and jaws. It will not be possible to explain all the incidents given by me above, by typical alteration of the masticatory apparatus, simply because they were not derived from the sure basis of the type. When one observes an insane person with pronounced prognathism, one cannot be sure that this prognathism is caused by the disturbance of interior secretion; firstly, it must be proved that this prognathism found with these individuals is undoubtedly pathological, secondly that the blood glands produced this pathological state. But how can this be done?

Two years ago at the London Congress I pointed out to you my reasons why a case can be considered a deformity. I found this basis in the theory of inheritance. The method I applied I shall try to explain by some cases from my experience.

Fig. 1. Girl, 10 years old, well-developed, exterior impression high grade cretinism (in profile, Fig. 2), prognathism is remarkable. Father sound.

Mother nervous since earliest childhood, suffering from convulsions inherited from mother, likewise hereditarily afflicted.

Psychiatrical diagnosis: extensive epilepsy, weak mentality on hereditary basis.

| LATERAL PARTS OF THE UPPER JAW | FATHER | MOTHER | SON | DAUGHTER (THE GIRL) | DAUGHTER 2 |
|---|---|---|---|---|---|
| Dist. of 2 mol. -- | — | 43 | — | — | — |
| " " 1 " -- | 46 | 39 | 46 | 40 | 39 |
| " " 2 pre. -- | 40 | 36 | 40 | 36 | 35 (v) |
| " " 1 " -- | 34 | 33 | 35 | 31 | 29 (iv) |
| " " canine -- | — | 31 | 32 | — | — |
| LOWER JAW | | | | | |
| Dist. of 2 mol. -- | — | — | — | — | — |
| " " 1 " -- | 42 | 40 | 42 | 40 | 40 |
| " " 2 pre. -- | 36 | 35 | 36 | 35 | 35 |
| " " 1 " -- | 32 | 31 | 32 | 31 | 30 |
| " " canine -- | — | 25 | 25 | 25 | 25 |

Fig. 4. The lateral parts of the upper jaw and the lower jaw are inherited by the son from the father, by both daughters from the mother. All three children inherit the intermaxillary from the father. The girl's intermaxillary, however, is still more protruding. Breadth and form of teeth of the father to be seen with the youngest daughter, those of the mother with the son (Fig. 5).

The girl has broader teeth. It is probable that the alterations, namely excessive growth of the teeth (breadth) and of the intermaxillary, represent the disturbance of growth in this case. The cretinoid habitus (ear, nose, eye) seems to confirm this.

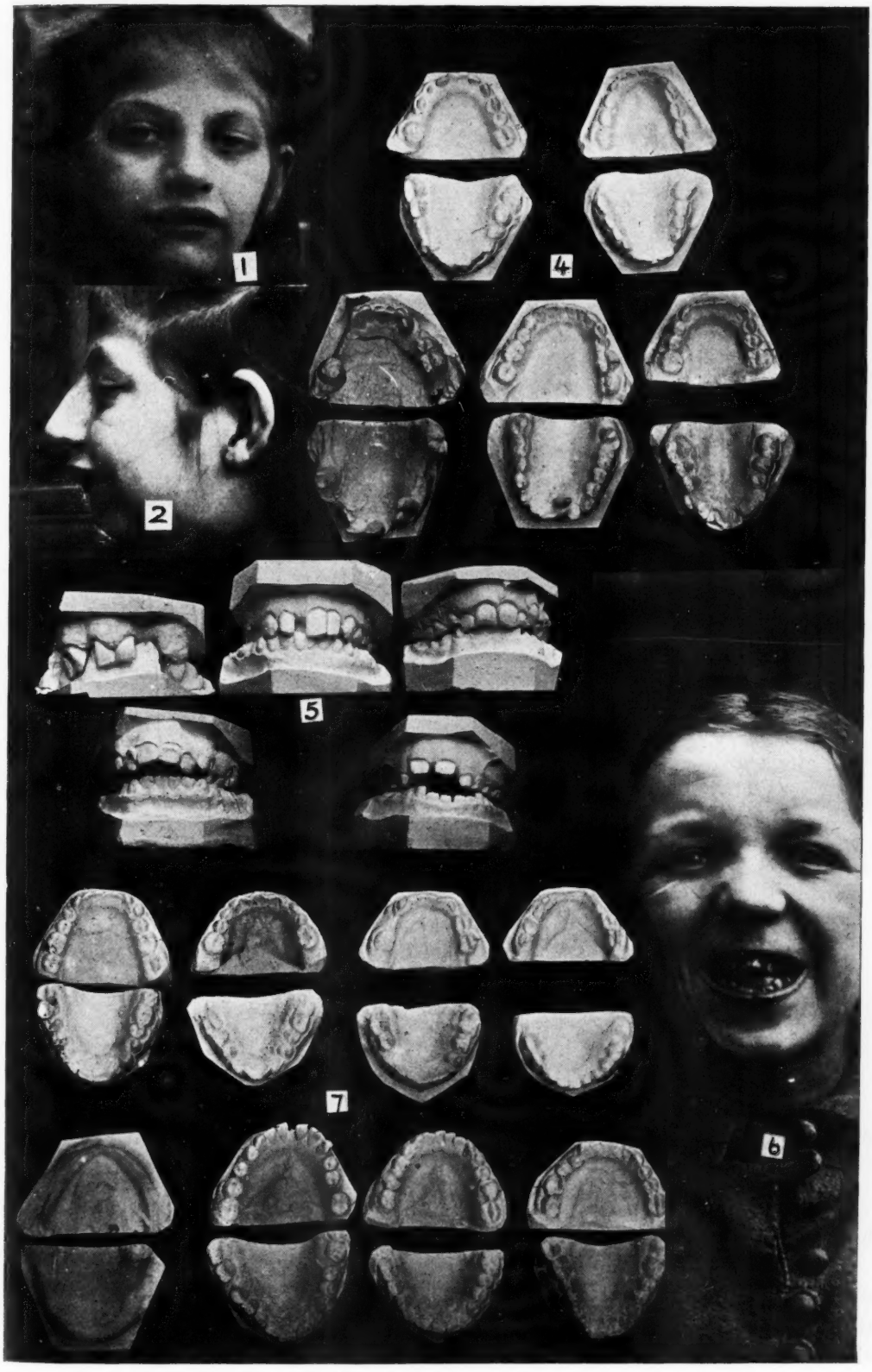
In spite of this absolutely cretinoid exterior impression the mental capacities of the girl are by no means so impaired as one would expect. A disturbance of growth also seems to be developing with the youngest daughter, namely, the open bite representing a hindrance of growth in the intermaxillary.

This is a case of epilepsy inherited through four generations.

Fig. 6. Girl 13 years of age, extremely backward in growth, has five brothers and sisters and one step-sister. Mental development of the girl extremely backward, suffering from periodical epileptic convulsions, likewise one of her sisters. The youngest daughter shows disturbances of speaking. She is so mentally abnormal that she could not be admitted to a public school. Another daughter shows coarse features with hair all over the skin and cheeks, and a bass voice. Father is psychopathically inclined, having inherited this from his father. Mother always healthy, no signs of mental or physical disturbances. Psychiatrical diagnoses: hereditary epilepsy, mental debility. Father and mother were odontically normal.

Fig. 7. Results of measuring lateral parts of upper jaw and lower jaw: Daughter 1 = daughter 2 = son = daughter 6, the same form as the father. Daughter 3 = daughter 5 = the same as the mother.

The form of the intermaxillary bone: Daughter 1 = son = daughter 3 = mother. Daughter 2 = father.




Figs. 1-7.

Daughter 5 and daughter 6 are beginning the second dentition in the front.

The girl has an extreme deformity of the upper jaw v-shaped, intermaxillary exceedingly pointed, with faulty eruption. The front of the lower jaw lacks development; the four incisor teeth show a torsion on the axis of length. Beside this she has distinct physical alterations of the body, known as rickets.

Fig. 8. All children of the first as well as of the second marriage show high grade open bite, most extremely so with the girls.

(3) Girl of ten years of age (Fig. 9). Father sound, mother psychically abnormal, high grade hysteric. The one daughter and one son are physically and mentally sound; they all have abnormal bite.

The measurements show (Fig. 10) lateral parts of upper and lower jaws: Father = son. Mother = daughter 1 and daughter 2.

Intermaxillary the same with all three children, only with the girl considerably shortened, stunted in growth, and eruption of teeth retarded.

Psychiatrical diagnosis: very intelligent, hereditarily severely afflicted hypomanically from mother's side. Mother highly hysterical and has a tendency to mania which she inherited from her maternal side.

Fig. 11. The disturbance in question consists, as can be seen, in a hindrance of growth of the intermaxillary.

(4) Girl 11 years old. Father and mother pretend to have been sound, one child died at the age of 1¾, one miscarriage. The girl was born at seven months with double hernia, at 8 months convulsions began, lasting until she was six years old. Backward in school.

Psychiatrical diagnosis: mental debility, physically weak.

Fig. 12. Father and mother have a normal bite, the girl also in the lateral parts of the upper jaw and the lower jaw. In the intermaxillary retarded eruption, perversed torsion of the axes, stunted growth of the intermaxillary bones so that the canines had no space. (Fig. 13.) In the picture the disturbance has already been regulated by orthodontic treatment.

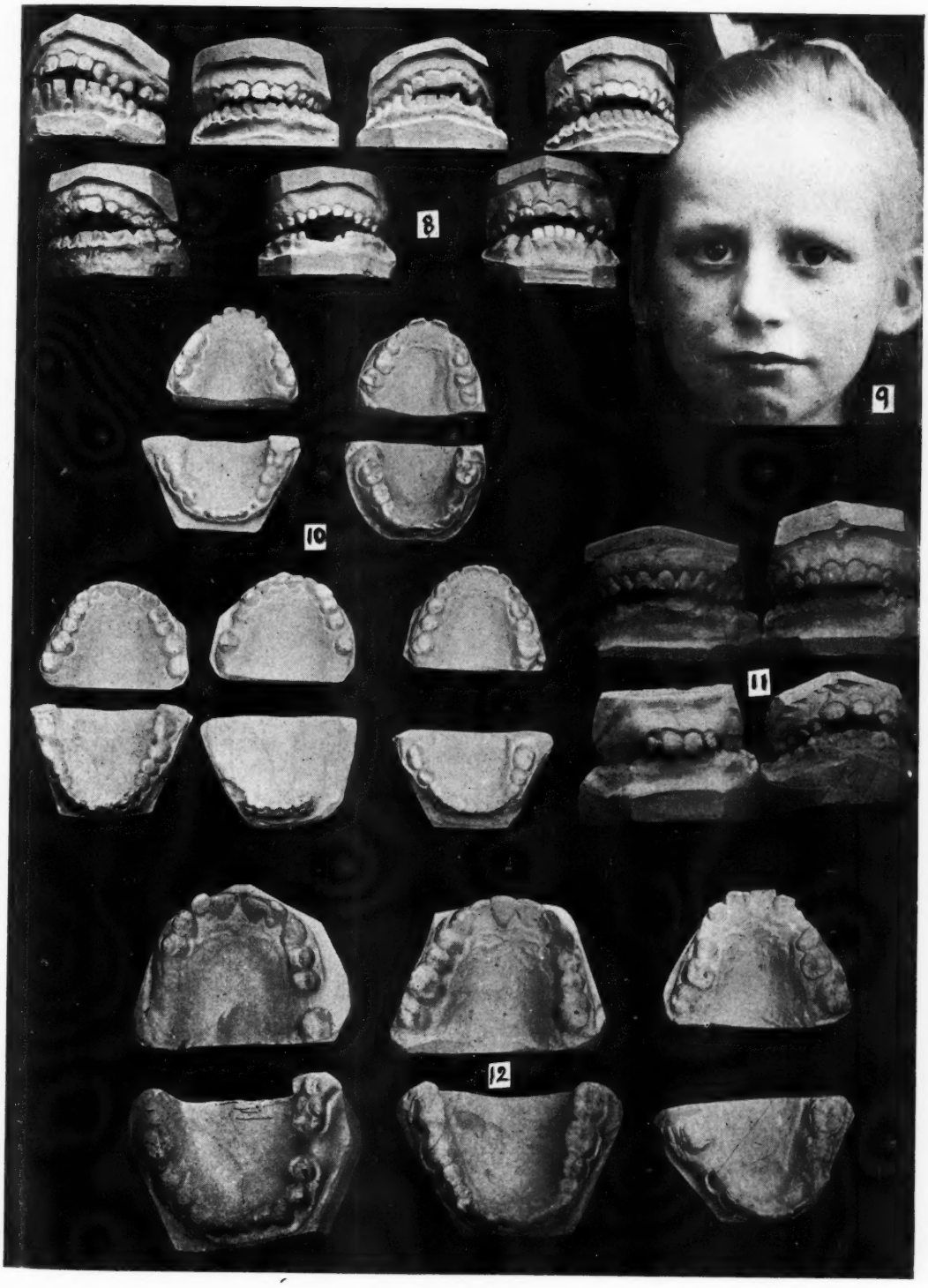
(5) Girl of 11 years of age. In this case also the intermaxillary was disturbed. Father and mother said to be sound, daughter has never been ill. Both father and mother have normal bite. (Fig. 14.)

The daughter's lower jaw is exactly like her father's. The lateral parts of the upper jaw remained narrow, so that the occlusion was moved bucco-lingually, intermaxillary slightly protruding.

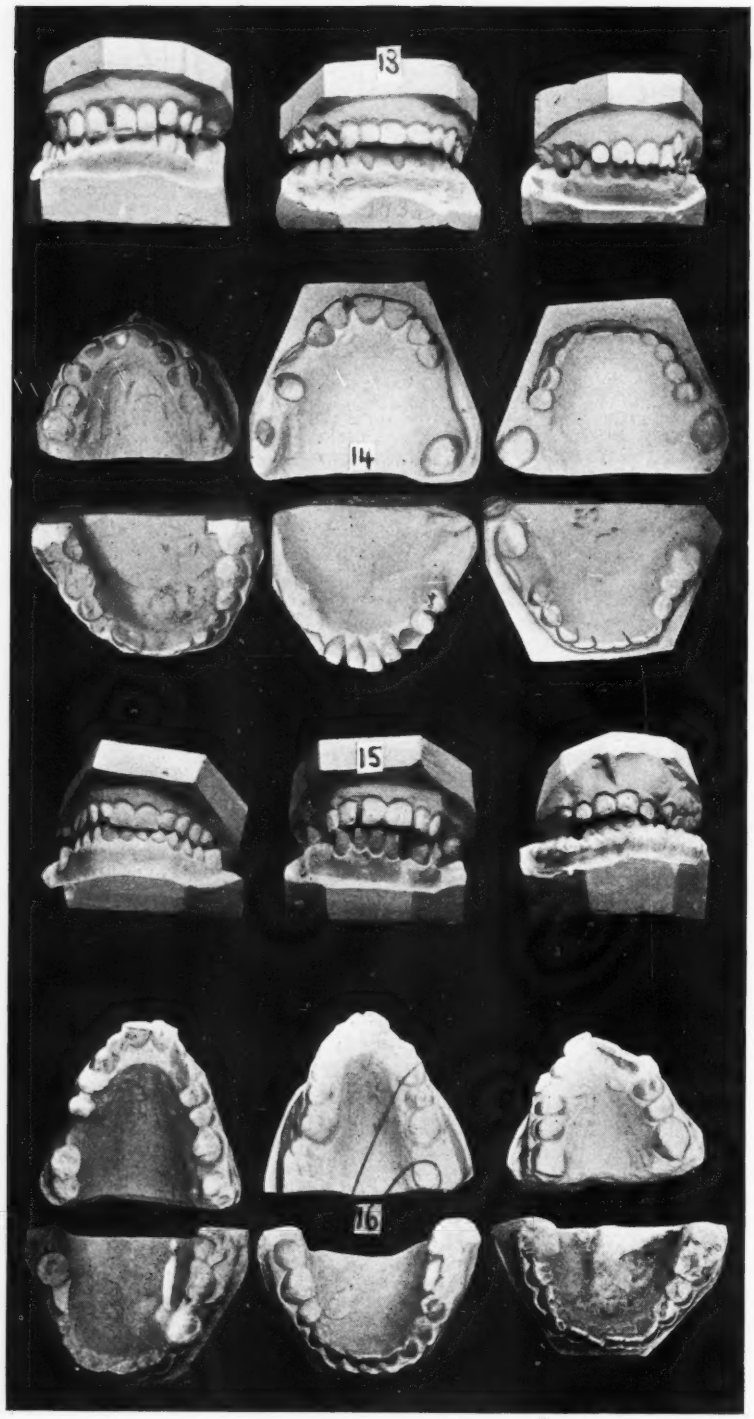
Psychiatrical diagnosis: weak, badly developed.

Fig. 15. Especially noticeable in this case is the hindrance in the lateral growth and the protrusion of the intermaxillary.

(6) Two girls, 12 and 15 years of age. Maternal grandfather 80 years of age, healthy, has the same abnormality of jaw as the mother and both daughters. Mother very nervous. Has three sisters and one brother. Both the sisters and the brother show the same abnormality of jaw. The occlusion of the third sister is normal. The above-mentioned two girls are very nervous, of pale complexion, often ill and suffering from excessive perspiration.




Figs. 8-12.




Figs. 13-16.

(Fig. 16.) Jaw measurements laterally of the upper jaw are the same in the mother and one daughter, and of the lower jaw the same in all three.

Fig. 17. The intermaxillary bone is stunted in its growth in all three, and in the one daughter extremely so, and at the same time she is more nervous than the other.

Thus the abnormality of jaw has been inherited at least over three generations and seems to be inherited in a progressive degree. One might describe this with Talbot's expression, "inherited neurotic palate."

(7) Girl 12 years of age. Father sound; mother's family defective physically; son healthy; daughter strongly psychopathically afflicted. Both children have the same lower jaw as the mother. (Fig. 18.)

Lateral parts of upper and lower jaw the same in son and mother, but slightly narrow in the daughter.

Intermaxillary stunted in growth with faulty eruption.

Psychiatrical diagnosis: severe hysteria with maniacal symptoms.

Fig. 19. Deformities consist of stunted intermaxillary bones, with faulty eruption and slight lateral crowding.

(8) Fig. 20 is a boy 18 years old and looks only 10. He has suffered from convulsions, is extremely shy and malicious, and is very tiny and weak. The teeth show hypoplasia, the bite slightly open with alveolar prognathism.

(9) Fig. 21. This picture shows a boy of 12, with mental weakness, disturbance of speech, badly developed, pale, skull large and asymmetrical, occiput surprisingly protruding, forehead broad and prominent, nose very broad. The bite shows a disturbance of growth in the intermaxillary region and open bite.

Fig. 22. This is a photograph of the models of a young fellow who fell on the occiput when he was 2 years old; he lost consciousness and was ill for some time. He is tall but weak and mentally backward, and shows no interest in anything. He has a v-shaped upper jaw compressed laterally.

Fig. 23 shows open bite as a typical form of the abnormalities mentioned above.

The next three Figs. 24, 25 and 26, show three children with open protruding bite, the last with faulty eruption.

In Fig. 27 is seen a pronounced abnormality of the skull with mongolism. The outstanding feature is the topsy-turvy appearance of the intermaxillary bone.

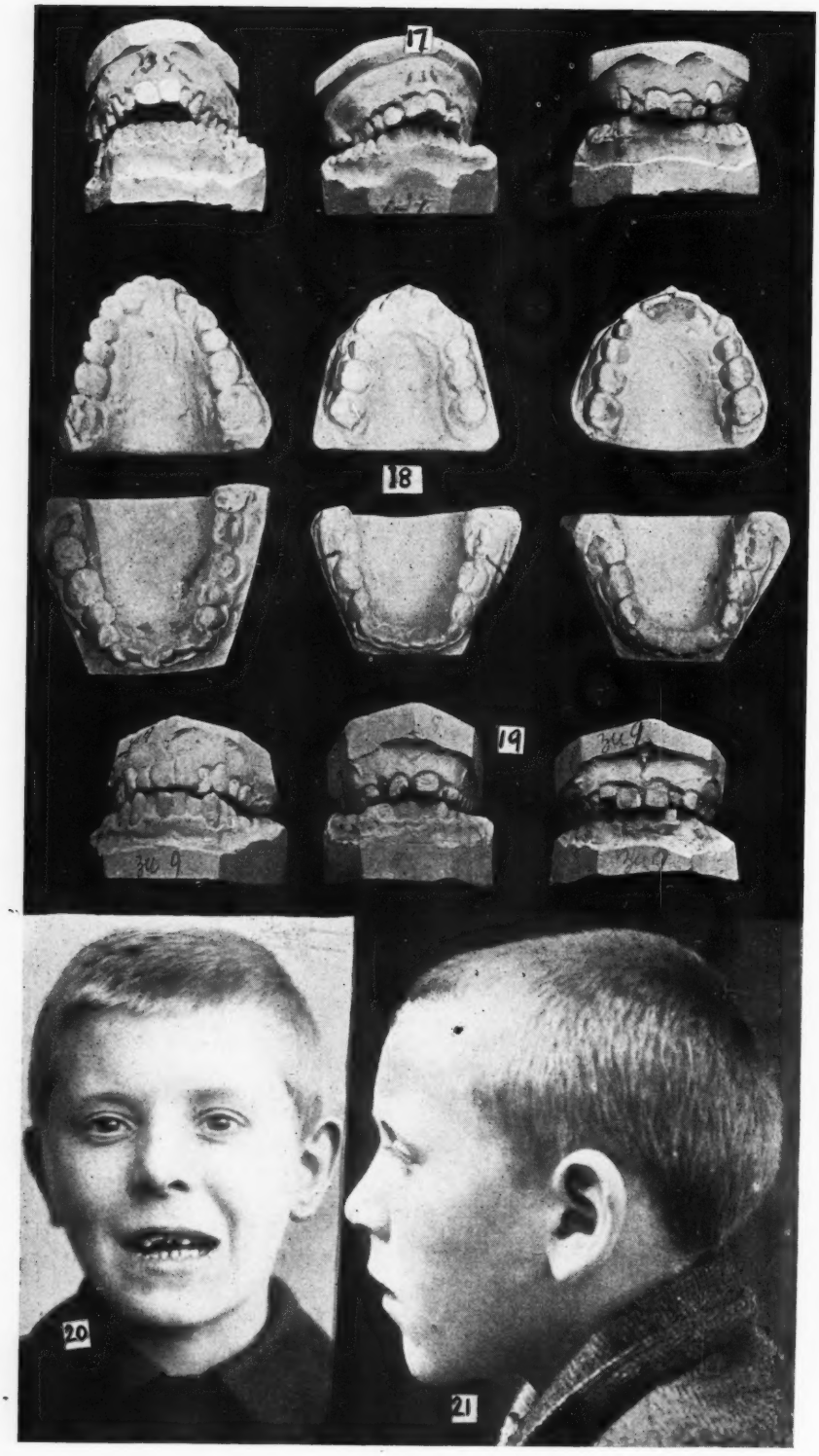
Fig. 28. V-shaped upper jaw with extreme protrusion with:—

Fig. 29. Acromegaly combined with hypertrophic forms of the teeth and jaw bones.

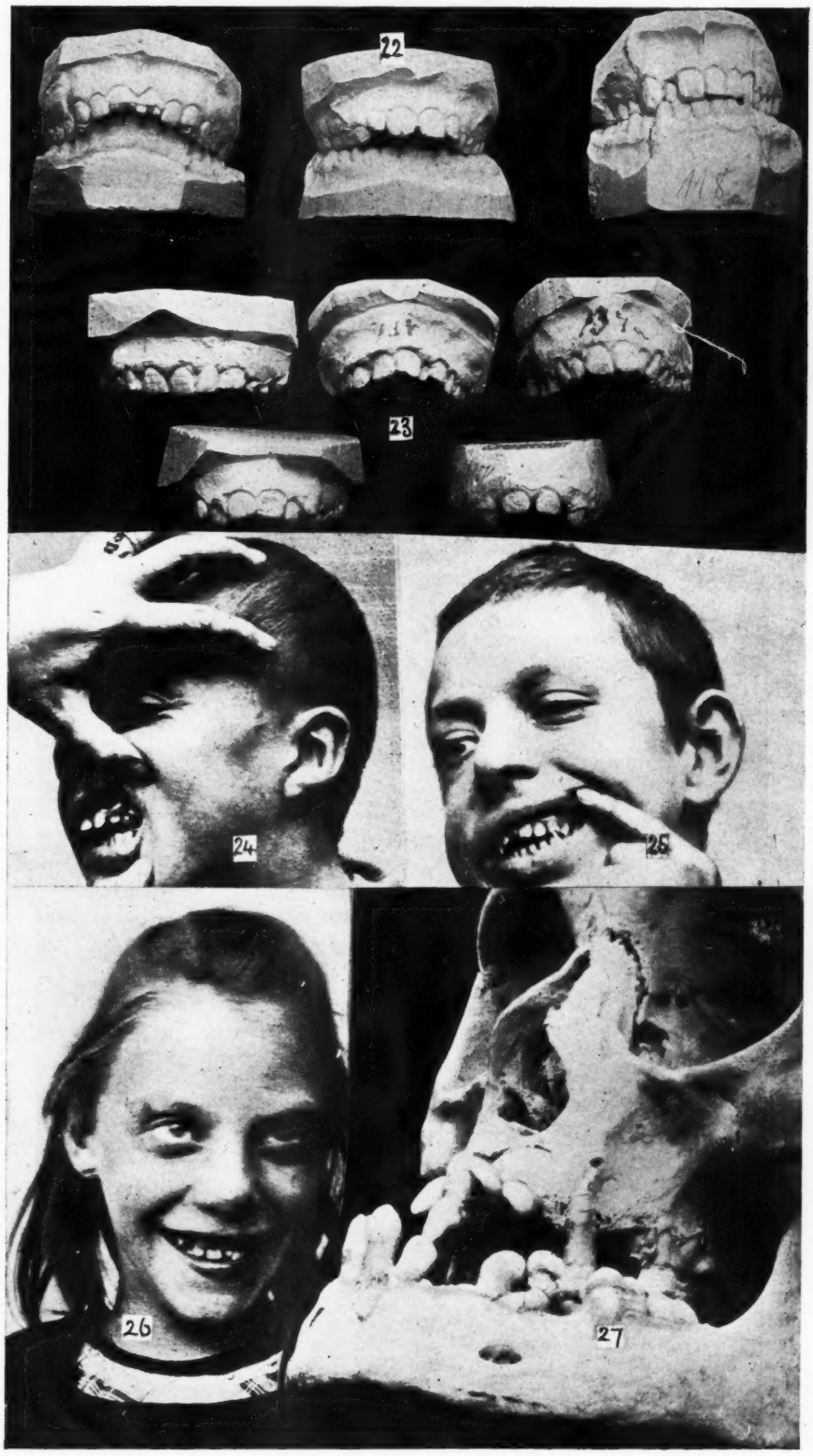
Fig. 30-*A*. Neurotic form of upper jaw of a young girl, with the brother (Fig. 30-*B*) mentally sound. Narrowness of the upper jaw seems to be indicated.

Fig. 31 shows the occlusion of both.

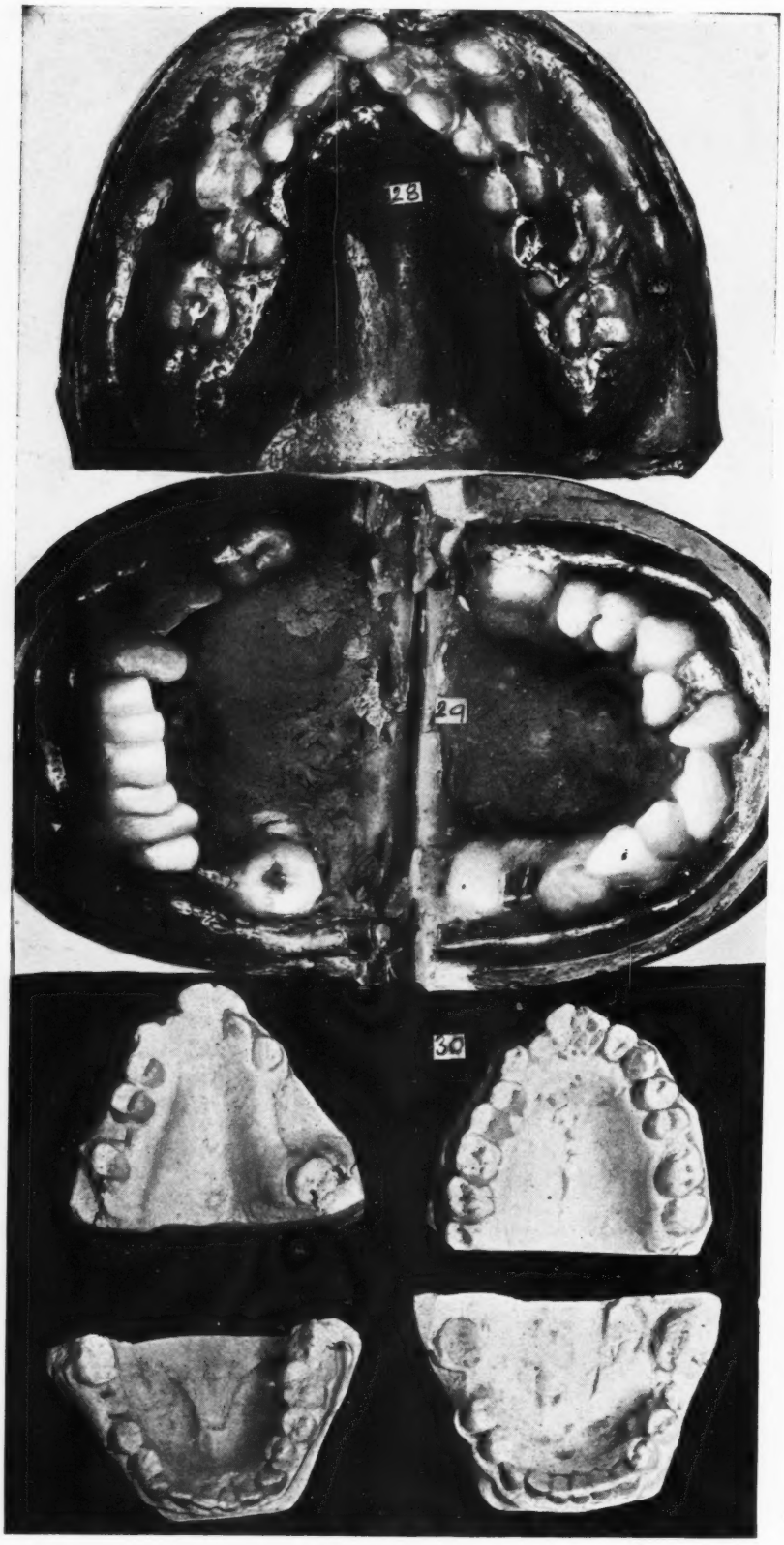
Figs. 32, 33, 34. Some typical cases of hereditary syphilis, with semi-lunar defects of the central incisors, with typically shaped teeth and defective molars.



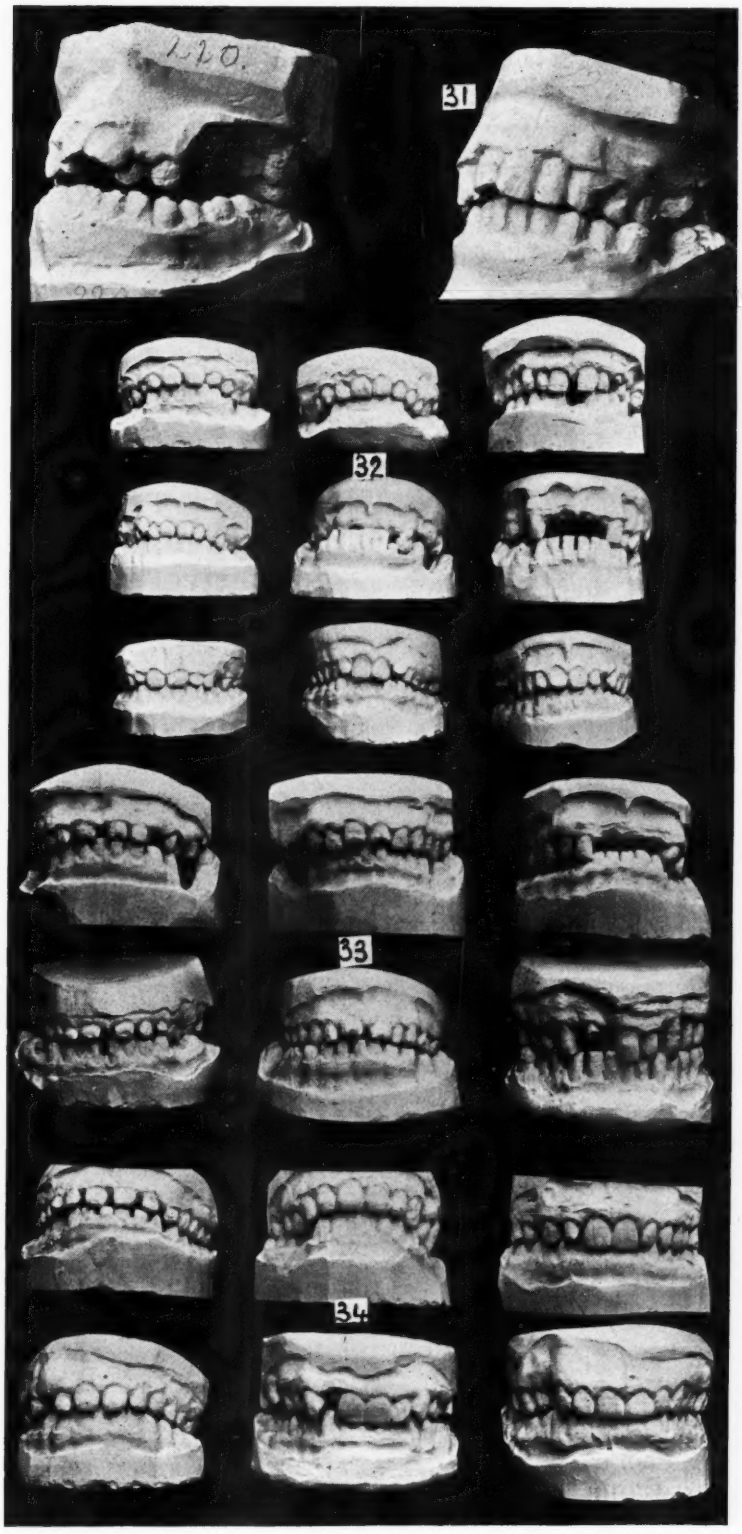

Figs. 17-21.



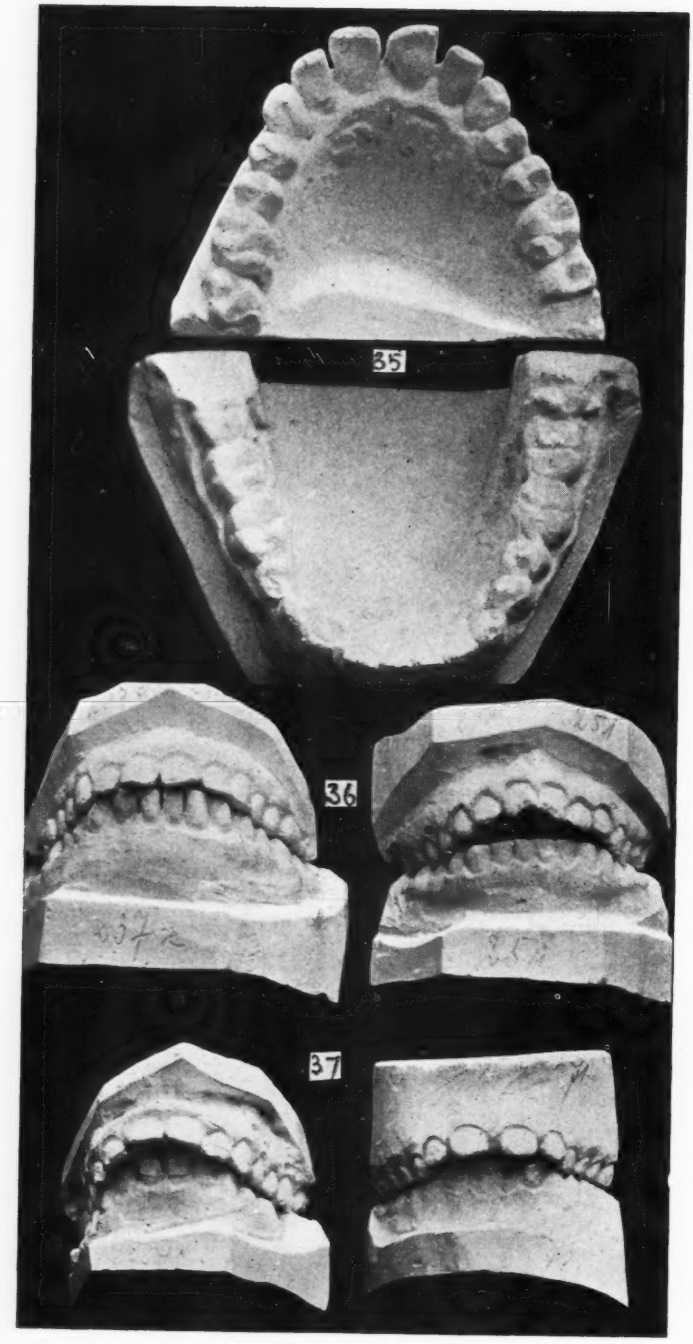

Figs. 22-27.




Figs. 28-30.




Figs. 31-34.




Figs. 35-37.

I shall now draw the conclusions of my researches. The chief deformities of the masticatory apparatus, which occur in individuals of psychical defects, in the first place consists in a disturbance of the trophoneurotic development of the intermaxillary.

These deformities are remarkable firstly as a hindrance of growth, secondly as a protrusion of the jaws as well as of the teeth, thirdly faulty eruption of the teeth.

The deformities of the lateral parts of the upper jaw chiefly consist in hindrance of growth in breadth, whereas those of the lower jaw show growth in length and rarely in breadth.

The psychical defects accompanying these deformities of the jaws have the same cause, namely the disturbance of the ductless glands. The character or form of the psychical defect is of no importance. The different forms of anomalies of jaws and teeth will occur in cases of complete idiocy as well as with slight forms of epilepsy and hysteria. Talbot made a very fine observation when he called the deformities occurring with hysterical individuals "neurotic palate."

Of course, the problem still to be solved in which of the glands is responsible in each case, for any typical deformity of the jaws. This, however, is known already, that an abnormal hypophysis produces acromegaly. To my idea there is another organ which will prove of great value in our researches, namely, the ovaries.

I will give some instances. With some women who had undergone ovariotomy I observed an excessive protrusion of the front teeth, which is shown in Fig. 35. Most probably the protrusion of the front teeth with those individuals whose sexual functions have ceased to be normal, have the same cause, namely, a deficiency of internal secretion of the sexual glands. In Figs. 36 and 37 is shown the same excessive growth in the front. The mystery as to whether only the disfunction of the ovaries or other correlated blood glands produced these deformities must be solved. Research into these questions is now possible, and will be made by me on the well-known reaction of Abderhalden.

In some cases I found that the thyroid gland was affected, and in one case, which showed the beginning of prognathism of the lower jaw in a girl 12 years old, I found a disfunction of the hypophysis.

### DISCUSSION

*The President* said the members had had a very interesting paper on a very obscure subject. The functions of the endocrine glands were still very doubtful in many cases; it was not known what each one was supposed to do, and still less did orthodontists know the disturbances caused by the abnormal functioning of any one of the endocrine glands. He was sure, however, that most of the members had had occasion to see in their practices some of those poor people whose minds were not normal, and certainly many of those present would be able to bring forward their own personal experiences in this field. If any member could prove or disprove Dr. Kadner's theories he would be very glad to hear him.

*Mr. Chapman* remarked that shortly after he had become qualified he had had an opportunity of going round a lunatic asylum, and in a small room there he had been surprised to find a very large collection of plaster models of patients' mouths. That had been

the first occasion on which he had had any suspicion that there was any connection between insanity and irregularities of the teeth. However, he had not been convinced then that it had a tremendous lot to do with it, and he was glad to hear from Dr. Kadner that there was only an increase in the percentage of defects in cases of insanity rather than that irregularities were a potent cause of the trouble. He had been particularly interested in the six cases of open bite which Dr. Kadner had shown on one of his slides, and also in the other cases showing a similar condition. It did seem to him that such cases made them suspect that heredity must have something to do with the etiology of those cases of irregular teeth. He did not see how orthodontists could get away from that point of view, and if that was so Dr. Kadner's paper only confirmed Mr. Northcroft's paper and Dr. Jansen's paper, in which it had been forcibly brought home that such a state of things started extremely early. Whether they arose *de novo* or were hereditary, or were both separately or in combination, it was difficult to say, but it seemed to him there could be no question whatsoever that the causes were probably antenatal to a very large extent. The further orthodontists went into the matter the more it was going to help them in their treatment. He did not quite gather from Dr. Kadner's paper whether he put down the cause to defective internal secretion on the part of the individual, or whether he went further back and put down the cause to defective internal secretion on the part of the parents. Perhaps Dr. Kadner would enlighten him on that point. He desired to thank Dr. Kadner very much for having gone into the matter so fully. He believed orthodontists could all gather cases which would help Dr. Kadner in his work.

*Dr. Andresen* asked if there was any distinct connection between malnutrition and glandular insufficiency.

*Dr. Barrows* said he had a case of a boy—an intelligent fellow—who had something the matter with his spine; it was getting more and more curved, and all kinds of splints had been put upon him. Also one of the boy's legs was withering. There was not room for the upper left cuspid. The others were fairly good. The molars were biting a little lingually. He (Dr. Barrows) put on an appliance and had made room for the cuspid to come in, and he had then sent the boy off on his vacation. When the boy came back he was class 3. The thing was getting worse all the time and the boy was now very bad indeed, and it seemed that the lower jaw was growing every day. His back was also getting crooked. Was it possible that the boy could suddenly develop acromegaly?

*Mr. Chapman* said he had a patient—a boy—coming of a very healthy family, with a large number of sisters and some brothers who all seemed to be extremely healthy. He suspected that the boy's mandible was coming forward. The boy was about 14 or 15 years old now, and it seemed to him that it might have come forward a quarter of a premolar in a couple of years or so. He did not know whether he was in error in putting it down to acromegaly, but he did not believe that acromegaly was found in children so young, and he would be very glad to hear Dr. Kadner's opinion on the point.

*Dr. Oliver* said he was sorry he was not capable of discussing Dr. Kadner's paper. Dr. Kadner had done some wonderful work—work into which orthodontists would be compelled to go. He believed there were cases of orthodontia which orthodontists could not treat until the cause had been removed, and he believed some of those cases were due to glandular troubles. He, personally, knew of one case in his own practice of a young girl of about 14, very much overweighted and lacking in mentality. When he first worked on the case the lower arch seemed to be working normally but the upper arch gave considerable expansion. It had been a class 3 case when he had begun on it, and it was a class 3 case when he had left it. He had used every type of appliance of which he knew, even going so far as to place on double intermaxillary appliance in order to move the teeth forward. The patient was a very good patient, doing exactly what she was told. He had called in her mother and had said to her, "I have something to say to you with regard to this case," and the mother had replied, "I know what it is; you cannot do any more." He had said, "That is so." He had then advised the mother to place her daughter in the hands of a specialist, who had made a thorough examination, including all blood tests and everything that went

with such an examination. The doctor had applied x-rays which showed that practically the whole floor of the cellular tissue was lacking. The girl had then gone to a brain specialist, after which he did not know what had become of her. Such a case was impossible for treatment from an orthodontic standpoint. He also knew of another case of a boy in which one side of the jaw grew and the other side remained. This case was treated by some of the best orthodontists in America, with no result. Personally he was very much interested in the question of glands. If there were cases which were producing such deformities, the question arose as to whether orthodontists could or could not help those cases. If they knew what cases to treat, and what cases not to treat, they would probably save long-drawn-out treatments which would never be correct. He hoped Dr. Kadner would enlighten them on that point. He appreciated the paper very much indeed, and he trusted Dr. Kadner would continue his good work and would master his science.

*The President* said Dr. Oliver had very appropriately expressed what was the truth of the matter, namely, that if the cause was removed the effect disappeared. A great many of these cases, as Dr. Oliver had said, could not be treated until the cause had disappeared.

*Dr. Hipwell* raised the question as to the best age to treat such cases—whether to start on the patients when they were 6, 7 or 8 years old, when there was a certain amount of nervousness, or at 11 or 12 years old, when they were built up and stronger.

*Dr. Oliver* asked Dr. Kadner whether or not it was a question of overdevelopment of the mandible, or a question of underdevelopment of the maxilla bone, or both, in these endocrine cases.

*The President* said Dr. Hipwell's remark about nervousness reminded him of a case which he himself had had of a mentally abnormal child—a kleptomaniac. Every time the child came back the appliance was out; there was a band off or a broken arch. The last time the child had come, he had taken care of her for nine or ten months all through the school year, and he had not done one thing. He had not developed the jaw a quarter of a millimeter. The last time that she came to him everything was out of her mouth except a couple of bands. He had ligatured her appliance with good bronze ligatures—and the members knew that when a bronze ligature was put on properly, as he thought he had put it on properly, it was there to stay. He thought that it was curious that it should have come out, and he said to the girl, "You were here last week. How did this appliance come off?" The girl replied, "I was sleeping, and I took a deep breath and it fell out." The girl, of course, had a very abnormal jaw. It was not an open bite but it was very narrow. He would like to mention one other case which he had seen—one of those cases which was beyond treatment. It was a case of idiocy. The patient was a female about 14 years old but was about the size of a child of 8. She was generally undeveloped. Her medical history was not known. Her antecedents were not known. She was an orphan. She was a child who had been living in the North of France and was sent back during the war. All that was known of her was that she had a sister who was normal. She was almost endentulous. She was a patient of the clinic to which he went, so that he had been able to follow the child from the age of 6 or 7. Therefore he knew that she had not had any teeth extracted except the temporary teeth, which had fallen out. He knew it was a case where the teeth had not developed. He had had x-ray pictures taken, and she had one or two molars and one or two incisors, and that was about all. She was an idiot. He had been very glad to hear Dr. Kadner mention Dr. Talbot, because Dr. Talbot had done much comprehensive and extensive work on the degeneracy of the human jaws, and his work was very much on the same lines as that of Dr. Kadner. Though perhaps Dr. Talbot's premises and conclusions might differ, still he had noted that in degenerates, and particularly in idiots in Europe (because the work had been done in Europe some thirty odd years ago), he had found there were very marked deformities of the jaw and irregularities of the teeth, especially narrow and saddle-shaped arches. There was one thing which he would like to ask Dr. Kadner. Dr. Kadner had shown the effect of heredity—that fathers and mothers and children had very much the same jaws. It was also known that some defects were inherited, but he would like to ask Dr. Kadner if he had gone into

the life history of the parents, whether he had tried to find out if one or both of the parents were syphilitic, or whether there was any history of epilepsy in the family. All the members knew how heredity was affected by alcohol; they knew that in regions where there was heavy drinking there were more idiots and degenerate children than in other centers. For instance, in Brittany there was a good deal of drinking; there were a great many drunkards there, and there were also a great many degenerates, and, for the same reason, a great deal of tuberculosis. Dr. Kadner had not mentioned alcoholism. He would like to ask him whether he had gone into that question and found that among those idiots the parents had been addicted to alcohol. Dr. Kadner had shown some interesting cases of open bite. He desired to ask him something which was not directly connected with the paper, but which was interesting in connection with open bite, namely, had he noticed that in those cases which he had examined open bite was associated with malformation of the teeth—pits and grooves and hypoplasia of the enamel? It was generally accepted that the two went together, but he had seen one or two cases at home with perfectly developed teeth and open bite. Therefore he would like Dr. Kadner to state whether in his experience the two conditions were always associated. Dr. Kadner also mentioned about trying to determine which endocrine gland was responsible for this or that condition. It was understood that each gland had a special function, but he (the President) believed that it was becoming more and more the accepted view in authorised medical circles that there was an interdependence of the glands, and that the action of one gland depended very much upon the action of another. For instance, to take the example upon which Dr. Kadner had insisted more particularly, the genitalia did not have a specific action—or rather the disfunction of the genitalia—but depended largely also upon the function of the adrenal glands, thyroid gland, and so forth. Therefore, he did not know exactly to what extent Dr. Kadner would meet with success in trying to determine the specific action of each gland upon the dental apparatus. It had been a very great privilege to the members to have been able to listen to Dr. Kadner's address. They would remember that two years ago Dr. Kadner had given a very interesting paper on heredity, and his present paper went hand in hand with it. It simply went to show how hard work and perseverance would go a long way to bring results, and to help the profession of orthodontia to become a real science instead of being a mere art and handicraft.

*Dr. Kadner,* in reply, said the question had been asked whether there was any connection between malnutrition and glandular insufficiency. The answer was No, only the disfunction. The glandular reaction only indicated the disfunction of the different glands. Dr. Oliver had quoted a case of hampering of growth in one individual and of promotion of growth in another individual, but he had not quoted a case of both hampering and promotion in the same individual. In one case there was a hampering of the upper jaw, and not a promotion of growth of the lower jaw. With regard to the President's question, some scientists said that deformation was not a consequence of alcoholism, and others said that alcoholism was a very bad thing for the development of the jaw.

*The President*: In one case alcohol is considered as a cause, and in the other case as a consequence.

*Dr. Kadner*: Yes. Continuing, Dr. Kadner said he thanked members very much for the interest they had shown in his paper. The aim of orthodontists should be to lift the darkness surrounding the etiology of jaw deformities.

*The President* said apparently they were all of the same opinion—that they must find out the etiology, and when they had found out why malocclusions occurred then they could begin to treat them more scientifically.

# THE RELATION OF THE DUCTLESS GLAND SECRETIONS TO THE DEVELOPMENT AND PRESERVATION OF THE TEETH IN CHILDREN*

By Hyman Goldstein, M.D., New York, N. Y.

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I WISH to express my thanks to the members and guests of the Dewey Study Club for the honor bestowed upon me tonight, in being asked to address you on a subject of such vast importance, yet so new to both the dental and medical professions. Although the dental profession recognize the necessity of cooperating with us, still I should like to see a closer relationship existing between the two professions, to help solve the problems common to both. That the endocrine secretions have a very definite influence upon the development and preservation of the teeth no one can deny, as it has been very clearly shown through scientific experimentation that they are inseparably involved in the various physiologic processes of the body.

Until quite recently little was known about the complex processes involved in cellular nutrition and growth of children. The ductless gland secretions play a great rôle in preparing the tissue cells to utilize the food elements. Malnutrition in children is more than a question of insufficient food or deficient vitamines. We find it in a great proportion of the well-fed, or well-to-do, as well as among the poor, and it is not rare to find an excellent state of nutrition where the food supply is scanty. The malnutrition which is severe enough to be reckoned as a factor in faulty development, irregular shedding of the deciduous teeth and the irregular eruption of both the deciduous and permanent teeth, is usually the result of a hypoplasia or endocrine insufficiency and at times an imbalance of the ductless gland functions. The vitamines, so vital for the sustenance of life, known as the fat-soluble *A*, water-soluble *B* and *C*, and even vitamines *D* and *E*, recently described, are present in most foods, particularly in animal fats, milk, fresh green vegetables, hulls of rice, and maize, tomatoes, yeast, potatoes, oranges, limes, lemon juice, etc. These vitamines are essentially stimulants and restoratives to the production of hormones and metabolic processes. There is a close connection between the function of these and the ductless glands, a fact demonstrated experimentally by McCarrison, Funk, Emmet, Allen and others. It seems that the hormones prepare the tissues, giving them receptive power to receive and properly utilize the vitamines. The proper functioning of the ductless glands to carry on all the tissue oxidations, in order to balance the catabolic and anabolic processes for the benefit of replenishing and building of tissues is essential. Should these body chemical food changes be inter-

*Read before the Dewey Study Club, March 23, 1926.

fered with by tardy or accelerated endocrine functions, the individual will suffer accordingly. This is the reason why the poor and rich child may suffer alike. And the rich child even more, because of the highstrung nervous sort of environment, in which it is brought up. The rich almost always get their own way about everything. They indulge in a lot of delicacies and sweets and go to a number of house parties, which alters their endocrine balance. About the puberty period, the free mingling of the sexes at such parties is very injurious. At this time all the ductless glands of the body are endeavoring to adjust themselves because of the sudden activity of the sex glands, and the stimulating body functions are at their height. Should the child be further stimulated at this period of puberty by strong emotions of any kind, such as sex mingling, excess of school and music studies, or any other excessive mental and physical strain, the puberty ductless gland adjustment will be upset, oxidation processes interfered with, sympathetic and vagotonic nerve impulses—which control numerous vital organic functions—will be affected, and this accounts for the large number of dental defects and all degrees of malnutrition, that we find among the rich children. We find that even irradiation of foods by ultra-violet rays helps to prevent rickets when the same foods untreated would produce them. It seems that a change in the food or tissues is necessary in order that the tissues should be made receptive for that food, and the food changed to some assimilable and acceptable form, to make it selective to replace or build tissue, or both. Teeth and bone structures depend a great deal, as to normal shape, position and integrity upon normal tissue, and, therefore, altered metabolism due to altered endocrine functions during the developing period of childhood will interfere materially with the normal development of these structures, giving rise to all sorts of abnormal shapes of the jaws, abnormal bites and various degrees of malocclusion and also produce a predisposition to caries. Metabolism and nutrition are interwoven processes dependent upon each other, and therefore I will endeavor to explain very briefly the metabolic phase.

Metabolism involves all those changes that occur in our foods from the time they are absorbed from the alimentary canal, until they are eliminated from the organism. In many of these processes the oxygen absorbed from the lungs plays a very important rôle. Sajous, has shown that the adrenal medulla and thyroid are active in this process, taking up this oxygen and distributing it to the various tissues of the body through the intermediary of the blood. The changes directly due to this, the physiologic oxidations of the body, cannot be separated from the general metabolic phenomena of the tissues.

*Protein* is given to maintain tissue in repair, to promote growth, and in excess, to stimulate the organs to a higher level of heat production. In protein metabolism during the period of growth, in convalescence, during pregnancy, lactation or nursing period, the body stores protein, and, under these conditions, the balance is in favor of the food nitrogen. Normal nitrogen equilibrium shows the capacity of the body to digest and absorb protein food. This furnishes material for the formation of new living matter or the replacement of the loss of this matter that is continually going on.

From the supply of amino-acids furnished to the tissues by the digested food proteins, certain ones are selected to construct the particular tissue protein of the body so far as this is required for growth or tissue repair. The balance is not needed as nitrogenous material and, its nitrogen is removed by a process of deaminization while the remainder of the molecule serves for the purpose of energy supply just as nonnitrogenous foodstuffs might do. The thyroid extract increases the nitrogenous output and helps materially protein metabolism. The posterior pituitary lobe extract increases the power of the tissue to utilize fat and thereby is protein sparing. Adrenalin acts as a stimulant to the former and indirectly influences protein metabolism. The process of deaminization of the excess of amino-bodies is accomplished by the liver as by the body itself. The metabolic chemicals of proteins such as leucin, tyrosin, cystin, lysin, histidin and tryptophan must be derived from the protein foods ingested in order to be of value or to be utilized by the tissues.

The infant has the power of transforming 40 per cent of the proteins in its food into new structural machinery. It is apparent that proteins are especially valuable if they contain an array of units, which when reunited form body proteins. Such food proteins are those of milk, meat, eggs and fish. Plant proteins are much inferior to animal proteins. Gelatin and zein, in which one or more of the necessary units are lacking, i.e., tryptophan, cystin, tyrosin, etc., can never be reconstructed into new body protein and therefore have no value as a food.

*Fat.* The essential nutritive value of the fats is that they furnish energy to the body and, from a chemical standpoint, they must contain more available energy than the protein and carbohydrate. It is oxidized with the formation of heat energy; stored in the tissues as part of the body fat; it is synthesized to lecithin and, may serve under certain conditions as a source of sugar. The pituitary, thyroid, pineal, gonads and to a slight degree the adrenals influence fat metabolism.

*Carbohydrates.* The association of the function of the ductless gland secretions to carbohydrate metabolism is well known. Normally the blood contains from .08 per cent to .12 per cent sugar. During starvation the glycogen and sugar is derived from the protein and fat. Fifty-eight per cent of the protein ordinarily is converted into sugar. The regulation of the supply of sugar to the blood and, the constancy of its percentage is usually attributed to the liver. The regulation of the sugar supply of the body and its utilization is a matter of the greatest importance. Caries and gingivitis is quite frequent in diabetes. Carbohydrate metabolism may be accelerated or retarded by the action of the hormones of the ductless glands. The adrenals, pituitary, thyroid and the gonads influence carbohydrate metabolism while pancreatic insufficiency of its internal secretion is the cause of true diabetes. The relation of endocrine dysfunction to carbohydrate intolerance and caries during puberty and pregnancy is well known. Carbohydrate foods furnish a source of energy for the needs of tissue cells and particularly muscular work. The oxidation of the sugar furnishes a constant supply

of heat needed by the body. This oxidation also protects the body protein. An excess of carbohydrate stores glycogen and synthesizes fat. It constructs nucleic acid. The structural development and integrity of the teeth, jaws, and environing tissues depends fully upon a properly proportioned mixed diet and balanced functioning of the ductless glands. P. R. Howe, writing on the subject of the conservation of the teeth states that, "The full complement of teeth and their proper arrangement are factors in the development of the facial and nasal anatomy of the growing child." In over two thousand children examined at the Forsythe Dental Infirmary for Children, he found all degrees of malnutrition. The dental decay was wholesale. Many of the children were undersized, or growth went on in an abnormal manner with great length of limb and no breadth of body. Others were too fat with flabby flesh. Many were pale and anemic. Nervous disturbances, skin and special sense organ defects were numerous as many cases of enlarged glands, adenoids and tonsils were present. All of this description referring entirely to a dietary or nutritional disturbance per se, is in reality a disturbance of the basal factors that have to do with the oxidation processes of the body concerned in metabolism, making it possible for the body tissues to utilize the food elements which are the normal functioning hormones or internal secretions. Not only should the food selected for a diet contain the number of calories, have a proper calcium and phosphorous content and a good quality of vitamines but it must also be properly prepared and suit the taste buds. It should favor and promote the physiologic processes of digestion. We must please the mental factor and appease it, which really starts the digestive juices, by stimulating their origin and production.

*The Inorganic Salts.* The body contains in its tissues a considerable amount of inorganic material. Each one of the salts has a special nutritive value and metabolic history. Including the bones, the average amount of ash in the body amounts to about 4.4 per cent of its weight. The bones contain most of it, about five-sixths in the adult and somewhat less in the child, because the proportion of animal matter is much greater. The muscles and soft tissues contain about .6 per cent ash of its moist weight. The ash is made up of chlorides, phosphates, sulphates, carbonates, iodides, fluorides and silicates of potassium, sodium, magnesium, iron and calcium. In the body fluids the main salts are chloride, carbonate and phosphate. They maintain a normal composition and osmotic pressure in the liquids and tissues of the body and, by virtue of their osmotic pressure, they play an important part of the composition of living matter. The proteins of the body contain definite amounts of ash, and if the ash is diminished, their properties are seriously altered. Calcium and phosphorous in various combinations make up most of the tooth and bone structure. Iron salts enter into the production of hemoglobin, influence normal coagulation of the blood, rhythmical contractions of the heart muscle, irritability of nerve and muscular tissues. The permeability of the capillaries depend a great deal upon the calcium salts. Animal experimentation and clinical observations have shown the close relationship existing with its interwoven functions between the metabolism of salts and the ductless glands.

*Calcium Metabolism.* The metabolism of calcium appears to be regulated by the ductless glands acting together as a group which are concerned with this function. It is found in the body in two forms: (1) Fixed in the tissues, helping to build up the framework of the body. (2) A floating quantity of lime, ready to be called upon when required. It is in the loose state of combination easily ionizable, that it is required to make "good" the wear and tear in all forms of repair. The fixed lime has passed through this embryonic state of development. The ionizable calcium is waiting to be utilized in the process of evolution. The enamel of the tooth is the hardest structure in the body and has been estimated to consist of about 90 per cent calcium phosphate. It is definitely known that the calcium requirement in the very young is about two and a half times that in the adult. In rickets there is certainly a deficiency of calcium and phosphorous in the bones and, yet it is known that children who get far more of these elements from the food than what is necessary still develop rickets. Some of the rickety cases show a normal calcium and phosphorous concentration in the blood. Others show a low phosphorous and a high calcium content while the majority of cases show a lowering of the phosphorous content and a slight lowering of the calcium content. Of course these examinations are delicate and the errors may be high which alter the results materially. However, facts show that although the patient receives such food as milk of which one quart contains many times the daily requirement of body calcium, and even the blood may be high in calcium content yet the bony tissues and teeth will not take it up, therefore something else must help the hard structures assimilate this floating calcium, and the internal secretions are intimately involved with calcium and phosphorous metabolism. In these cases the thymus gland acts as a calcium absorber. It is antagonistic to the reproductive glands (which are calcium excretors) and controls its overdevelopment. It is also concerned in the synthesis of nucleic acid which controls phosphorous metabolism, this with calcium has a direct bearing on tooth and bone development. Since the thymus gland is now known to be most active before puberty; it is an organ functioning throughout the period of development from early infancy, to late childhood. If function of the thymus gland is impaired through infectious or contagious disease, growth is retarded, enamel defects begin to show, rickets and even marasmus may ensue.

The parathyroid secretion participates in the defensive function of the body and also calcium metabolism. Its impaired function leads to osteomalacia and soft teeth. It seems also to affect the enamel.

The anterior lobe of the pituitary favors calcium retention and absorption, whereas the posterior lobe and the gonads act as excretors. This balance accounts for good development and regular arrangement of the teeth. The abnormal functioning will lead to high crowded arch or to a large spread arch and irregular arrangement of teeth or on the other hand spaced teeth. This will depend upon the hyperfunctioning or hypofunctioning of the anterior or posterior lobes. The adrenal glands stimulate the saliva through the sympathetic system making it more alkaline, rich in

mucin and minerals which favors preservation and growth of the teeth. The thyroid and pineal glands influence development and preservation of the teeth by enhancing calcium deposition. During infancy and childhood when normal body growth is most essential, the gonads are practically inert while the other glands enhancing calcium assimilation are most active. We must remember, however, in considering the effects of endocrine disturbance on structures, that these organs are not independent of one another, but form a closely related series which mutually influence one another. If one gland is impaired through any disease or experimental removal, it may give rise to results that are not only due to hypofunction of the crippled gland but, symptoms of hypersecretion of another gland to compensate for the loss. When we consider the question of an upset in the sum total of intake and output of lime salts, we cannot in practice consider one gland at fault but must think of the whole group interacting one with the other. The thyroid and pituitary stimulate the suprarenal system, which inhibits the pancreas, ovaries and parathyroids. The pineal and thymus glands inhibit the reproductive glands. In childhood and adolescence all the calcium that can be obtained is required for growth. The thymus gland during childhood holds at bay the reproductive organs, because calcium absorption is now important, since this is a period of so-called calcium hunger. If all goes well and absorption is sufficient and the calcium hunger is satisfied, no harm will take place; but any upset in this calcium absorption and deposition, will be followed by calcium starvation imbalance, and caries, along with other teeth and bone defects, will result. Just before puberty, we all observe as the time of excessive caries. Note the contrast in old age, when the calcium eliminators are accelerated, lime not now required for growth is stored in awkward places, arteries degenerate, joint troubles commence, caries is practically nonexistent, the teeth being of excessive hardness and dark, and pyorrhea prevalent. Whereas, during middle age if all goes well the calcium balance is more stable, lime being only required for "wear and tear." Through physiologic research work we find that it is necessary for the child to take one gram of fat for each pound of its weight in its food daily, to facilitate absorption and assimilation of the lime.

## CONCLUSION

In conclusion, I wish to emphasize the fact that the ductless gland secretions play an important role in the development and preservation of the teeth in children. Dr. Milo Hellman, in his excellent article, "The Process of Dentition and Its Effect on Occlusion," states that "wealthy children are accelerated in growth and retarded in dentition, and the poor children on the other hand while they are exceedingly retarded in their growth, they are accelerated in their dentition." He also shows by carefully compiled statistics that the teething in the rich is not only prolonged, but interrupted, whereas in the poor, both the shedding of the deciduous teeth and erupting of the permanent ones presents a continuous process and in the rich an interrupted process. Figuring on the basis of occlusion it appears that this intervening latent period has a profound effect on the relation of

the teeth, because "the dentures of the wealthy children show about 17 per cent while those of the poor show nearly 60 per cent normal in occlusion." This indicates that something more than nutrition alone governs the development and growth of the tooth structure. Endocrinology is bringing to light many unknown etiologic factors which operate even through the maternal-placenta (fetal) circulation and through infancy and childhood, as a cause of abnormal development of the jaws and teeth and giving rise to all degrees of malocclusion. This means that following correction of abnormal teeth relations by means of appliances, or before or during treatment, depending on the individual case or indication, every effort should be made to insure normal functional relations of the surrounding parts. This implies close cooperation between the physician and dentist. The correction of the constitutional defects will make the percentage of failures less and the prognosis better. It is best to endeavor to locate the trouble by typing the case. The hypoadrenal type of malnutrition, is evident in the pale, emaciated, asthenic child who tires easily, always feels chilly and has various brown moles and discolorations of the skin. They have a capricious appetite but do not gain in weight, the mentality is poor and blood pressure is low. They are subject to attacks of nephritis. The hyperadrenal child is usually tall, dark, thin, with long silky hair, delicate and active. They often complain from indigestion and anemia. The lymphatic type child appears undernourished, flabby and phlegmatic. They breathe like asthmatics and suffer from large glands, adenoids and tonsils. They often have blood dyscrasias such as purpura, scurvy and leucemia. The hypothyroid type are lazy, obese, constipated, easily fatigued and poor mentality. They have poor appetites. The deciduous teeth are retained for a long period. They suffer from frontal and occipital headache and various arthritic and muscular pains. The athyroidea or cretin if left untreated stops growing physically and mentally. I have seen a girl thirty-seven years of age with practically no mentality. She had all of her deciduous teeth decayed in her mouth. She is 42 inches tall, 35 inches around the chest, 23 inches around the head, upper extremities 17 inches and lower extremities 20 inches. Had she received thyroid extract in gradual increased doses thirty-six years ago when the condition should have been recognized; she would now be a normal girl of normal height and intelligence, but unfortunately at that time treatment was unknown. The hyperthyroid type usually shows the abnormality about puberty. They often have a slight exophthalmus and goiter swelling. They show evidence of increased metabolism and sympathetic irritation. They are tall, thin, highstrung and mentally active. Dermatoses, urticaria, neuritis, migraine headaches are frequent. They blush and perspire freely. Therefore we must discover in what type or group the child belongs, i.e., hypo- or hyperadrenal; hypo- or hyperthyroid; dyspituitary giant or acromegaly child; small or dwarf individual; or the lymphatic type. If any of the above abnormal findings are noticed in the child, the mother should be notified that the condition must be corrected if possible while the teeth are being attended in order to get proper results. As a rule the physician

sees the case first, then it should be his duty to inform the parents to bring the child to the dentist with whom the physician should communicate, for proper dental care. Each profession should know what the other is doing. The prevailing idea, that because the first teeth are deciduous they are in need of no attention and must therefore be neglected is an erroneous one, and because of this false belief even the wealthiest children have their teeth woefully neglected. Abnormal habits must be discovered and every effort made to eliminate them. In addition to organotherapy the child's mode of living must be regulated regarding mouth hygiene (oral habits as already mentioned), hygienic environment, regular hours of sleep, normal bowel function, regulated meal hours and proper diet of good, wholesome, palatable, nourishing food. Malnutrition deprives the growth impulse of the teeth and bony structures as well as all the other tissues of the body of its sustenance, and, as shown the fundamental cause in most instances is some endocrine disturbance. I therefore wish to emphasize the need for the early recognition of the dyscrinism, or ductless glands at fault, and its treatment in conjunction with the dental care in every case where such signs are observed, no matter how slight.

# ENDOCRINOLOGY IN RELATION TO DENTISTRY*

By William Lintz, M.D., Brooklyn, N. Y.

BY ENDOCRINOLOGY, we understand the study of the glands of internal secretion, the physiologic and pathologic effects on the body of their hormones, the substances elaborated by these glands.

While it is true that almost every cell in the body contributes some substance which is utilized in the complex chemistry of our economy, the cells of certain organs or glands, contribute substances called hormones, which are so vital for our very existence and form, that serious functional as well as somatic derangement—even death—results when these hormones are perverted or entirely eliminated.

These glands rarely function by themselves, usually acting in conjunction with the hormones of other glands which they may enhance or antagonize.

We are what these glands make us. In disease their hormones play a most vital rôle in our recovery.

Many patients labeled as neurasthenic, hysterical, neurotic and vagotonic are in reality suffering from disturbance of the internal secretory glands.

The judicious administration of the ductless glands will sometimes accomplish wonders in these cases. It is surprising what a few grains of thyroxin, the hormone of the thyroid gland, will accomplish, or what insulin, the hormone of the islands of Langerhans in the pancreas will do. In the former instance it will change a lazy, blathering idiot into a normal human being; in the latter instance it will awaken a hopelessly fatal comatous diabetic, who may continue to live thereafter his normal span of life.

Truly, it will certainly be worth your while to have a more intimate knowledge of the glands of internal secretion, for their hormones affect every branch of medicine, dentistry included. (I believe dentistry to be nothing else but a medical specialty, the same as laryngology or otology.) It is not only an increase or diminution in quantity that produces disease, but very often there is a change in quality as well.

The enumeration of the chief glands of internal secretion and a brief outline of their special function and the main diseases produced by them, is now in order, so that we may more fully understand its influence upon the dental apparatus.

The main internal secretory glands are the thyroid, parathyroid, thymus, pituitary, pineal, and suprarenal, the ovaries, the testicles, and the islands of Langerhans in the pancreas.

1. The *thyroid* is intimately concerned with the metabolism of the body; it stimulates oxidation, participates in the control of growth, both physical

*Read before the Dewey Study Club, New York City, February 16, 1926.

and mental, and acts in intimate association with the ovaries, testicles, thymus, pituitary glands and adrenals. In association with these glands it governs calcium metabolism; it neutralizes poisons introduced into or manufactured in the body and actually participates in the process of immunity. It is remarkable how free from infectious diseases are people with an active thyroid. Overactivity of the gland leads to hyperthyroidism, goiter or Graves' disease. Underactivity leads to hypothyroidism, myxedema or cretinism.

2. The *parathyroids* are the glands chiefly concerned in the maintenance and regulation of the calcium metabolism. They also destroy toxic substances which have a predilection for the nervous system. The destruction or extirpation of the parathyroid causes tetany and finally death associated with a serious loss of calcium.

3. The *thymus gland* exerts a profound influence from birth to puberty, when it retrogresses and the thyroid becomes the leader of the internal secretory glands. The thymus controls mineral metabolism, especially of calcium. It is not only concerned with the growth of bone, but regulates the phosphorus metabolism, stimulates the blood-forming organs and lymphatic glands and regulates the growth and activities of the sexual organs of childhood. Disease of the thymus leads to malnutrition, and faulty mineral metabolism, especially rickets.

4. The *ovaries* have a profound influence on the sexual development and life of women and produce ova for fecundation. Castration causes masculine women the same as the removal of testicles causes feminine men. The ovaries control menstruation and maintain pregnancy in the early months. They regulate oxidation and are intimately concerned with the calcium metabolism of bone. When the ovaries cease to function the menopause ensues, irrespective of the age of the woman.

5. The *testicles* are to the male what the ovaries are to the female; they produce spermatozoa instead of ova. They regulate and control the male sexual form and life. The spermin of the testicles is intimately concerned in the control of nutrition, oxidation and the cell activities generally. Diminution in the activity of the testicles or their complete removal leads to feminine men or eunuchs.

6. The *pituitary gland* which is essential to the life of man is located in the sella turcica of the skull. It controls growth; stimulates the cardiovascular system and the involuntary muscles of the intestines and uterus. It is composed of two lobes: anterior and posterior. The anterior lobe is concerned in metabolism, and disease brings about adiposity, asexualism and reduced bodily activities, including subnormal temperature and marked asthenia. The posterior lobe yields pituitrin which, when injected, raises blood pressure markedly and stimulates the unstriped muscles, especially the pregnant uterus. It favors carbohydrate metabolism. Pituitary people are gentle and kind people. When it predominates in the male at the expense of the adrenals, the result is feminine men. The size of the giant we see at the circus, as well as that of the dwarf, is caused by disease of the pituitary gland.

7. The *pineal gland* located in the skull produces marked changes in metabolism which result in a hastening of maturity, physical, mental and sexual. I have seen a child four and a half years of age with pubic hair, fully developed breasts, and the sexual organs of a matured woman, all due to a tumor of the pineal gland.

8. The *adrenal glands* maintain the tonicity of the involuntary muscles, particularly of the heart and blood vessels, hence blood pressure and circulation depend largely upon adrenal activity. The adrenal gland is composed of two parts, the cortex and medulla. The cortex exerts an antitoxic action and is concerned in the control and development of the ovary and testicle. From the medulla, we obtain adrenalin which has a powerful effect upon the sympathetic nervous system. Adrenalin constricts blood vessels, stimulates the heart and raises blood pressure. Addison's disease and all chronic infectious diseases accompanied by weakness, low blood pressure, and emaciation are due to damaged adrenals.

The hairy, assertive, adrenal-predominating individual has strength, endurance and progressiveness and is by nature a fighter. When combined with a strong pituitary, he becomes the champion prize fighter type. Women in whom the adrenals predominate are as a rule, very virile, with red hair and masculine traits. They take great delight in taming wild animals and think nothing of stopping a ferocious dog fight. They want to boss everything and everybody, and, under one pretext or another, clearly demonstrate that they have very little use for the usual domestic duties of womanhood. They are continually agitating and ranting. They form the public speaker or militant suffragette.

This association of the adrenal preponderance with a judicious combination of the other internal secretory glands, especially of the thyroid, is fortunate. Persons with such a combination make excellent executives, and, on account of their endurance and judgment, are the ones who "put things across."

A lack of adrenal secretion is responsible for the society of spinsters, pacifists, confirmed bachelors, ill-doers, and the great army of persons pursuing nonprogressive vocations, such as cooking, tailoring, serving, etc. Those having adrenal markings grow to be old people.

9. The *islands of Langerhans* in the pancreas, by means of their active principle, insulin, regulate the carbohydrate metabolism. When this hormone is lacking, diabetes occurs.

You will ask me what endocrinology has to offer the dental profession? How does endocrinology influence the dental apparatus? You will say that this regulation and correlation of the functions of the different bodily organs by chemical messengers or hormones, in addition to the earlier recognized principle of nervous regulation, may be of interest to the physician in the understanding and treatment of disease, but how can it possibly interest the dentist? My answer is that the dental apparatus is an integral and very important part of the human body, subject to the same diseases and cured

by the same means as any other part. In the dental apparatus, the endocrine glands mirror most minutely their state of health; their proper or improper balance. We are what our endocrine glands make us. Racial and familial traits and characteristics are transmitted and regulated through the endocrine glands. I know of no better way of sizing up an individual than by examining his teeth. I always do this before employing people or appointing assistants. In the teeth you will read whether the individual is sickly or healthy, irritable or phlegmatic, whether he is lazy or energetic, lackadaisical or progressive, pugnacious or gentle and kind, an individual who goes off on a tangent with fads and fancies, or one well balanced, with a mind of his own.

Character can be read better by the teeth than by any other means. While it is true that a great deal of the study of endocrinology is still in the realm of speculation and hypothesis, it is equally true that a great deal that is known is established fact, based upon animal experimentation, numerous clinical laboratory observations, and postmortem investigation.

That the endocrines influence the dental apparatus is proved by Erdheims' experiment with rats, in which he produced tetany by extirpation of the parathyroid. Such animals always showed changes about the teeth which were very similar to the hypoplasia of the enamel seen in man. Fleischmann believes that in children hypoplasia of the enamel is always due to tetany. Others believe rickets to be the cause. It must be remembered that in both tetany and rickets we have a calcium deficiency, and it is possible that the endocrine glands may be at the bottom of both diseases. Deficient calcification of dentine also occurs in tetany.

Fleischmann and Krang have observed changes in the teeth after extirpation of the hypophysis and parathyroids.

Krang observed that the teeth of thyroidectomized pigs and guinea pigs are decidedly smaller than those of the control animals.

In a study of one hundred cases of homosexual men, where there is apparently a disturbance of the endocrine glands, particularly of the generative glands, Dobkowsky found that the average size of their teeth lies between normal male and female dimensions. There are more dental irregularities and decay in homosexual than in normal men.

In pregnancy the teeth suffer a great deal. It is not due to the fact, as commonly supposed, that the need of calcium for the fetus causes decalcification of the mother's teeth. The endocrine glands are responsible. The ovary, hypophysis, thyroid and parathyroid, as we have seen above, are intimately concerned in the calcium metabolism. In pregnancy these glands are markedly disturbed. It is not at all uncommon to recognize an early pregnancy by the appearance of the patient. The nose, lips, and tongue become thicker, the normal facial lines obliterated, and the expression coarse. The hands are thick and clumsy. Headache, chilliness and weakness are prominent symptoms. The bones become somewhat large and spongy. This physiologic acromegaly, due to pituitary disturbance, is more marked in

some women than in others. The same acromegalic changes in the maxilla are at times responsible for the complete loss or loosening of the teeth, especially the maxillary central incisors, where the sockets become too big for the roots. Slight acromegaly and changes in the dental apparatus are not always limited to pregnant women. Men, in whom this is frequently found, are scarcely aware of the disease, its symptoms being so slight.

Not all the trouble pregnant women have with their teeth, is due to the disturbance in the calcium metabolism. Much of it is due to the congestion of the blood vessels and its consequences. The hyperemia in pregnancy is not limited to the generative organs.

The internal secretory action of the ovary is to inhibit bone development. This secretion is diminished during pregnancy and therefore the calcium assimilation is increased. Pathologically hypersecretion of the ovary may result in osteomalacia which can be arrested by castration.

In the calcium assimilation, the ovary is antagonistic to the parathyroid, thyroid and hypophysis. In pregnancy these glands are altered so as to increase this action; they are hypertrophied. Elimination of the function or hypofunction of the thyroid inhibits the growth of bone, hence also the assimilation of calcium. In pregnancy the thyroid gland is often enlarged.

If a deficiency of calcium assimilation exists during pregnancy, whatever the cause, it will be detrimental to the skeletal system of the mother rather than that of the fetus, for the child in intrauterine life takes from the mother whatever it requires for its development regardless of the mother's needs. During lactation a reverse condition exists, since the child is dependent on the mother's milk for its calcium supply, any deficiency results in the poor development of the baby's skeleton.

Realizing the exact cause of the trouble in the dental apparatus of pregnant women, we see that local treatment is not sufficient. It is of the utmost importance to administer calcium in some form, in large doses.

It is hard for me to see why so many dentists refuse to do everything necessary to arrest the deleterious dental ravages in pregnant women. I see no contraindication for such work. In fact I see every indication.

*Caries.*—Caries occurs more frequently during the developmental years than after the twenty-fifth year of life. It corresponds to the physiologic alterations in the calcium metabolism under the influence of the internal secretions at puberty. The thyroid, parathyroid, ovaries, hypophysis and thymus are functionally related in the construction of the teeth. In cretinism anomalies of teeth and jaws are often met. During puberty, in chlorotic girls, there is a marked tendency to caries, characterized by menstrual disturbance and enlargement of the thyroid. The teeth show definite softness of the dentine and enamel structures.

In endemic cretinism and idiocy of endocrine origin the teeth are very large and clumsy. Fusion of the maxillary incisors is rare. This is seen in cases with a narrow dental arch, protrusion of the maxillary teeth and a high palate. In myxedematous and Mongolian idiots the deciduous teeth

are abnormally small, narrow and thin, with large interproximal spaces, and full of caries. The incisors and canines may be pointed. The deciduous teeth break down early. The permanent teeth are rarely involved.*

*Menstruation.*—Disturbed menstruation of endocrine origin is frequently reflected in the oral cavity.

Infantilism, with scanty menstruation, due to ovarian hypofunction is frequently associated with various types of dental anomalies, trema, diastema, retention of deciduous teeth, retention of phosphorus and secondarily of calcium.

I have seen stomatitis salivation and swelling of the salivary glands which make their regular appearance with menstruation and subside at its termination.

The acne eruption about the mouth, at the menstrual period, is so frequent and constant with many women that it forms an embarrassing indication of the activity of their generative organs.

I have repeatedly seen women with severe toothache at the menstrual period, which is as a rule pathologic in nature. Loosening of perfectly normal teeth, throbbing and neuralgic pains are not infrequent. I believe these are caused, as in pregnancy, by hyperemia of the blood vessels, a condition in these patients which is not limited to the generative organs. The vicarious bleeding from the gums and mouth at the menstrual time has the same explanation.

In persistent menorrhagia of endocrine origin, caries develop as a result of the calcium metabolism.

The redeeming feature of the menopause is that it influences the dental apparatus favorably. I have seen progressive caries cease completely with cessation of menstruation.

I believe Hutchinson's teeth are of endocrine origin. It is true that Spirocheta pallida have been found in the dental buds by Cuvallaro, Pasini, Nicolas, Massia and Dupasquier. This, however, does not explain why the spirocheta should attack and leave symmetrical deformity only in the central incisors of the maxilla. As a former pathologist I can state that, in congenital syphilis, I have found Spirocheta pallida in large numbers in practically every tissue and organ of the body, in most cases apparently causing much disturbance in these structures. Langer and Wassmund have recently demonstrated that in congenital syphilis the alveolar process becomes concave as a result of failure of full development of this part of bone. It is this primary hypoplasia of the intermaxilla which causes secondary changes that lead to deformity in the maxillary central incisors, changes that are known to us as Hutchinson's teeth. This explains to us why Hutchinson's teeth are symmetrically limited to the central incisors of the maxilla.

I believe with A. Cedercruetz (München Med. Wchnschr., November, 1925, p. 1960) that the cause of this hypoplasia of the premaxilla is of endo-

*Drs. Elkin and Howard in the study of endocrine disturbances have found one or more teeth congenitally absent in the cretins they have studied. Narrow dental arches and high palates are also found in patients that are not cretins.—Editor.

crine origin, the thyroid in particular. Gummata, which may be a direct cause of this hypoplasia of the premaxilla, are but rarely found. On the other hand the influence of the endocrine glands on the development and integrity of the osseous system is known to every one. That the syphilitic virus can and does attack the endocrine system, however, is well known.

It is here important to note that Hutchinson's teeth come with the second dentition, or about the seventh year, at a time when the thymus begins to retrogress and the thyroid to progress, at a period when the latter gland would be unusually sensitive to the syphilitic virus.

In this connection the case reported by Josephson is of special interest. He found typical Hutchinson's teeth in a simple case of hypothyroidism in the absence of syphilis.*

As far as I know no form of treatment will influence Hutchinson's teeth already formed. It would be of great importance, however, if in congenital syphilis, before the second dentition, endocrine gland treatment were administered along with the antisyphilitic treatment, to note whether or not there would be any deformed maxillary incisors. As far as I know this has never been tried.

In diabetes, the changes in the first portion of the digestive canal are rather constant: dry tongue, acid reaction of saliva, stomatitis, and caries of teeth, the latter being a pathologic symptom that occasionally gives rise to the first suspicion of diabetes, and is thus particularly of value if rapidly developing caries of the teeth occur in persons who have previously been immune. The urine of such patients should invariably be examined for sugar. The acetone odor of the breath may be the first sign of acidosis. To recognize these cases and start them on the right road is a life-saving procedure.

The endocrine glands stamp the teeth with indelible markings. The irritable thyroid individual has teeth which are thin, transparent, graceful and of a bluish grey-white color. I have observed nonerupted molars so frequently in hyperthyroidism that I wonder whether there is an etiologic relationship. While the hyperthyroid has a clean mouth and good teeth, the hypothyroid has a dirty mouth, full of caries.

The pituitary gland controls the size; the same applies to the teeth. The gentle and kind giant or obese person, with pituitary markings, has large square teeth, especially the maxillary central incisors, which are spaced and which are associated with direct primary pituitary function. The rest of the teeth up to the premolars may also be spaced. Overcrowding of the teeth because of large size may be a pituitary characteristic.

The bashful or secretive gonadotrope as a rule gives a history of mumps, which have involved the ovary or testis. The maxillary lateral incisors are the teeth presumed, by Kaplan, to be connected with the gonads and to

*We agree with Dr. Sinly when he states that Hutchinson's teeth are more the result of endocrine disturbance than of syphilis. We have also seen atrophy of the enamel of the teeth attributed to syphilis that is the result of some other constitutional disturbance. Atrophy of the enamel and Hutchinson's teeth have branded many children who were entirely free from the disease as syphilitic.—Editor.

carry the stamp of ovarian or testicular abnormalities in their shape, size and implantation. The greater the deviation of the gonads from the normal, the more definite the markings in the oral cavity. The lateral incisors as a marked gonad defect may not have erupted at all. In the male, small stumpy lateral incisors bespeak sexual impotence on a physical basis.

This view of Kaplan is not shared by every one. Lucas believes that anomalous or congenitally absent maxillary lateral incisors are often found in parents who have children with hare lip and cleft palate. I have recently observed a child with a complete cleft palate, who had small, stumpy, rudimentary, misplaced, maxillary lateral incisors. The same anomaly was observed in the mother of the child, and her two sisters and their mother. Two brothers were free from this anomaly. This would correspond with the observation of Lucas, who says that only the female members are the ones who transmit this anomaly. Timme believes that anomalous maxillary lateral incisors are indicative of a pluriglandular compensatory deficiency.

Others believe that this anomaly is part of evolution, since the maxillary lateral incisors are the teeth least useful; therefore there is a tendency for their disappearance.

Still others believe that this is of no significance, that it is only a curiosity which explains nothing.

The relationship, if any, between the gonads and the maxillary lateral incisors is a crossed one. I frequently see girls with right ovarian pain, especially at the menstrual period, who have anomalous left maxillary lateral incisors and vice versa. On the other hand I see gonadal pathology with no dental relationship.

The assertive hairy adrenotrope shows a marked power of endurance and progressiveness which goes hand in hand with an endocrine system that is perfect, and a canine tooth which shows he does not fear to face antagonism in any form, shape, or manner. Long, sharp canines are the adrenal dental markings. The grinding surface of such teeth shows a marked reddish brown coloration, and although softer in texture than the thyroid or pituitary variety, they have a greater degree of endurance.

The juvenile or childish thymotrope has the teeth of a baby, which are a bluish porcelain, thin and translucent at the grinding edge. The teeth in some children show a tendency to scalloping at the grinding edge. This trait may outlast the baby, and on rare occasions be found in the adult, when it points to the youth of the individual, regardless of years.

As far as treatment is concerned, it is evident from the meager outline of the subject, necessitated by the allotted time, that the study of the endocrine glands and their therapeutic application to the dental apparatus will give an opportunity to the dentist to render a real and wonderful service to his patient. The dentist must realize that to stop the caries of his female patient, he must inquire whether she has excessive internal bleeding of endocrine origin. The administration, as I have previously shown, of thymus, mammary and placenta in these cases will check the hemorrhage, or adjust

the disturbance in the calcium metabolism and check further caries. The dentist must realize that not pulling the teeth, to relieve the neuralgic pain in the menstruating girl, is the proper procedure, also that ovarian gland should be administered. He must know that the best and quickest way to clean up a dirty mouth is to administer a little thyroid along with his other treatment. He must understand that when he straightens crooked teeth he is but relieving the effect of the trouble; the cause of it has not been touched. He must administer to the child thymus or parathyroid, pituitary or pineal to suit the individual case, along with applying the various apparatus for mechanical purposes. He will then get down to the root of the trouble and his results will be both hastened and brilliant.

To treat patients endocrinologically, intelligently and efficaciously requires deep study of the subject.

# SIMPLIFYING ORTHODONTIC TREATMENT*

By Alfred Paul Rogers, D.D.S., M.A., Boston, Mass.

My motive for again appearing before this convention and presenting a subject relative to the use of muscles in simplifying the correction of malocclusion, is that I entertain a hope that my experience in this special field of orthodontia may prove a help to some who are anxious to reap benefits from this method of practice; or who may be pleased to again have placed before them concrete evidence, illustrating the simplicity and ease with which certain cases of malocclusion may be treated; or perhaps that I may be able to further your interest and foster investigation by some who are qualified.

It has been observed since first introducing this subject before the First District Society of New York in 1917 that responses of varying character have developed. Some few orthodontists have accepted the fundamentals and have made intelligent application of the principles involved. In numerous instances they have won a gratifying measure of success. Others seem to have accepted the principles as being quite true, but for one reason or another have failed to comprehend the real nature of the work. Their attempts at a practical application, therefore, have been characterized by a lack of understanding sufficient to make satisfactory progress. Others have accepted the principles, and have entered upon a more or less scientific investigation which I believe has revealed to them much of the truth. This I gather from published reports as well as many private communications. There are, of course, a few doubters representing that type of professional man who counsels caution and supports conservatism in the adoption of anything new or revolutionary in professional practice. While the offices of such are fully appreciated I am of the opinion that the doubter, as a rule, undertakes little of a practical nature, and that his statements and attitude in regard to this subject in particular are of little value outside of the wise counsel for care and investigation. There is a danger that he become a creator of deeper doubt rather than a promotor of confidence. The conscientious investigator, on the other hand, is a different kind of being, and it is to his efforts that we look with confidence for something of real value in the coming years.

It is true in our profession as in others, that in the scientific field the imagination must be active, for the very soul of science lies in that kind of imagination which constantly extends the limits of the possible. The escape from many of our difficulties is impossible without encouraging this type of scientific mind. That there is an awakening interest in the method of treatment under consideration is manifest by a few quite recent publications. Notably those by Dr. G. Izard, professor of orthodontia in the French School of Stomatology, and by Dr. E. Sheldon Friel, of Dublin, Ireland. Attention is being given the subject by men prominent in orthodontia in both Berlin

*Read before the Twenty-fifth Annual Meeting of the American Society of Orthodontists held at Atlanta, Ga., April 14-17, 1925.

and Vienna. From them we may look in the near future for reports of satisfactory progress, which reports should carry with them an increase of respectful interest and attention by many who have hitherto given the subject but slight consideration. As the subject is studied by men of scientific training and recognized practical ability, the profession in general should be able to master the details with greater sureness and certainty of success.

Time has passed where debate among those who have had no practical experience is of value, but for the sake of those who may be interested in analogical references I would like to read a quotation from an article on the "Evolution of the Human Foot," by Dudley J. Morton, M.D. Dr. Morton in treating of the evolutionary changes of structure has this to say which should have some influence on the minds of those who arrive at conclusions better through biologic discussion.

"Structural alterations are not the result of any variation in mechanical laws as they effect the development of the bone, but are the natural sequence of a disturbance in the normal function in its relationship to the various tissues, whereby the mechanical laws are caused to work habitually in an abnormal or exceptional manner. The laws are immutable; it is the manner of use that changes, and structural modifications follow in accordance with the change in function. Hence the only logical interpretation is, that an altered employment of mechanical forces by a structure inevitably causes the original structure to be molded by those forces so that they may work more advantageously in the newly adopted manner; and by the same process, wasting follows nonuse. The actual alterations of bone structure are accomplished by two very simple and well known processes, no matter if the alterations comprise marked changes of the entire structure or merely slight, localized rearrangement of the internal architecture; those processes are (1) increased growth, physiological hypertrophy, and (2) absorption, physiological atrophy, or diminished normal growth, as the case may be.

"It is not the writer's intention to enter upon a biological discussion of the transmutation of species, but in order to define an absolute basis upon which the differentiation of primate feet is shown to be allied to function, a consideration of the relationship of mechanical usage to evolutionary change becomes a necessary part of this study.

"'Wolff's Law.' In the first place, no other part of the body structure is affected by such violent forces as are exerted upon the comparatively small bones of the foot; in them the entire body weight is concentrated and its great stresses magnified by leverage. The average total of pounds per minute transmitted by the foot bones, is far greater than in any other member of the body. Consequently, if any part of the entire skeleton may be supposed to show the influence of function as a remodelling factor, it would most surely and conspicuously be the feet.

"Modification of structure in the living individual to conform with the manner of use has been recognized and accepted by the medical profession as a law, and is known as 'Wolff's Law.'

"Such structural changes definitely tend toward improving that structure for a more efficient performance of the altered function. This law applies to changes secondary to disorders, as well as to physiological development of a part due to the long continued use of a specialized function.

"For example, the writer had the opportunity of making x-ray studies of the feet of one of our American champion sprinters during his last year in college. Not only were the metatarsal bones fully 20 per cent longer than those of the average individual, but other modifications were to be observed throughout the foot structure, which conformed specifically with the mechanical requirements of that specialized usage.

"As the various specialized types of primate feet are studied, it will be found that their individual structural characters are invariably associated with a distinctive manner of use. There is a definite and distinct harmony of both the structural and functional mechanics, just as if evolutionary development were guided by the laws of engineering."

I hope to demonstrate to your satisfaction that the dental arches may be developed by increased functional activity of the muscles of mastication in the absence of any applied form of stimulation.

It has already been demonstrated that certain forms of malocclusion may be influenced toward the normal through the proper use of various muscle groups. We are all more or less familiar with those types of cases which, from an apparent state of malocclusion, tend toward the normal without interference of any nature, as illustrated in Fig. 1; but even in such cases we must not forget that the muscular influence is present and must be reckoned as a factor in development. The improvement in the position of the mandibular lateral incisors in Fig. 1, would not be expected should the tongue for any reason be unable to function. So I am firmly of the belief that these changes we see and do not have to treat have their share of muscular function behind them. It is not that I wish to overemphasize the use of muscles in seeking development, but we cannot ignore the fact that they constitute one natural developmental agent the activity of which we seem to be able to direct. It has also been demonstrated that during the progress

Fig. 1.

of treatment under mechanical stimulation, the use of the muscular function may enhance the treatment in that fewer appliances are needed, and that the retention of the corrected malocclusion is far more easily secured. It has been demonstrated too, that frequently one arch may be developed in a secondary manner by the use of an appliance on the opposing arch only, the secondary development being due to cusp relation and increased muscular function.

I think that Friel's suggestion that muscle testing should precede the application of exercises is correct in principle, especially so when the operator is inexperienced. In this field my own experience in muscle testing must be considered more empirical than scientific as no recording instrument has been used; but by long practice it has become possible to make certain, and oftentimes quite satisfactory tests, without the use of recording instruments. Of course, under such conditions the employment of careful judgment is imperative. To appraise the fine balance or lack of balance between various muscle groups, of course, can only be scientifically accomplished by the use of delicate instruments such as those suggested and devised by Friel. I can readily understand how the use of such instruments might have discouraged the undertaking of some very ridiculous attempts

at treatment. The use of testing instruments alone will not retard some from making attempts at treatment which are regrettable, but quite unavoidable in a profession where some seem to possess a tendency to proceed without thinking the problem through. We recognize this fault not only in the misapplication of the principles we are now considering, but we are also frequently reminded of this weakness in the professional judgment when we contemplate the crude and practically useless appliances which are everywhere in use among orthodontists. This is the more surprising when one knows that there are a number of highly scientific and efficient appliances of simple design that are available for use by the straight thinker.

In making application of the principles involved in adapting muscle development to the correction of malocclusion, it is necessary to bear in mind a few simple mechanical laws. The phrase "mechanical advantage" introduced in my first article upon this subject was used with the idea of conveying to the reader's mind the simple fact that before muscular tension could safely be increased that a suitable mechanical adjustment of the teeth should precede the application of such force. It would seem that the idea was perfectly clear and easy to understand, but it has not always been understood. For if it were one would hardly expect the orthodontist to prescribe exercises that call for movements transcending physiologic limits, yet I have heard of such things being done. Anyone should know that the temporomandibular articulation is limited in its action both by age and individual development. It is in relation to this articulation that the most serious blunders may be made in respect both to overextension and to unbalanced mechanical relation. As a consequence of such mistaken ideas, harmful strain may be imposed upon the temporomandibular articulation both laterally and bilaterally, but such unnecessary strain should not occur under a régime where adequate care and judgment are used. Therefore, let me add again, for the sake of emphasis, that to prescribe the vigorous use of the masseter-temporal pterygoid groups where conditions of mechanical disadvantage exist is positively unwise since in certain cases of distal and mesial occlusion mechanical advantage cannot be obtained until the arches first receive proper preliminary treatment through mechanical means. This is what is meant by the phrase "removing the points of interference." On the other hand, if one finds general atonic conditions of the muscles of the face and neck the improvement of these muscles by general tonic exercises which do not call for stress upon the teeth of either arch may be used with advantage, in many cases prior to the mechanical interference, or during the process of mechanical stimulation.

The fact that some men find it difficult to secure cooperation from the patient seems to defer them from seriously considering or employing these valuable aids to practice. This is regrettable. Doubtless there are some who will never be able to enjoy these benefits themselves or gain advantage for their patients. These individuals are apparently unable to influence the child to a point of confidence or to maintain interest. Practical success or failure in this field shall, therefore, always be in a large measure commensurate with the ability of the operator to first awaken interest on the part

of the patient and then to maintain it for a sufficiently long period to procure the desired result.

The handling of children may be considered an art, it is certainly not yet a science for the simple reason that there are many exceptions and very few obvious rules that one may follow. Due to failure in this direction many men who are not yet enjoying the benefits of this method of practice are depriving themselves of a positive advantage; because they have not thus far taken the time to give the matter a fair and deserving amount of their attention.

For practical results I suppose the most satisfactory method of teaching, whenever possible, may be found in the careful application of underlying principles, after first instructing the student regarding the result which should be expected. Such processes are not only interesting, but as the treatment proceeds the student is given an opportunity of seeing the law of cause and effect in operation in its relation to the particular subject in hand. Finally when the desired result has been secured the whole demonstration stands in the student's mind not only as a satisfactory demonstration of fundamental principles, but as a practical and reliable method for overcoming the difficulties under consideration. It is somewhat in this manner that I hope to demonstrate to you the advantage and reliability of the principles of muscle development coupled with the minimum use of orthodontic apparatus in the treatment of a variety of cases of malocclusion,—some of them considered generally as being very difficult of treatment and more difficult still in retention. In fact, some have proved failures after years of treatment by the usual methods, but have responded with surprising ease when placed under the influence of this more rational form of treatment. It is inconceivable how any one can raise objections to a method of treatment which in itself is simple, direct and logical, and where results are so easily demonstrable. It may be possible to utter objections relative to the theory of such practice, but there can be little substance left in objections of this nature when the theory in question is proved to work. It is the simple, the workable, efficient method of treatment that the orthodontist of today is in dire need. Evidence of this is seen on every hand. The orthodontist should welcome any method that can be shown to be in many cases surer and often quicker, that may be used to relieve our patients of strain, and where the patient himself may be taught to take some personal part in the process which is to ultimately improve his physical condition. We will, therefore, proceed to demonstrate this method of treatment.

The first practical result that I am going to illustrate is a young girl thirteen years of age representing a bilateral distoclusion. The treatment consisted in the removal of certain points of interference. This was accomplished through the development of the maxillary arch by the use of the lingual wire with loops as is shown in Fig. 2. The points of interference having been removed and a position of mechanical advantage made possible, this child was given exercises which involved primarily those muscles which are used in the act of mastication. As these muscles became strengthened and accustomed to perform their function in the new relation between the arches, the ability to maintain the mandibular arch in its proper mesiodistal

relation became less difficult. The interferences on the maxillary arch were the only ones that were removed, and when this was accomplished the child was encouraged to develop the muscles of mastication, and after a sufficiently lengthy period she began to function in the normal position. Exercises involving the muscles of the neck were used in the treatment of this child together with the general tonic exercise. The result of this method of treatment is very well illustrated in Figs. 3 and 4. Here then is a correction of a distoclusion by the use of one lingual wire, and that applied to the maxillary arch; no intermaxillary elastics were needed during the treatment of this child.

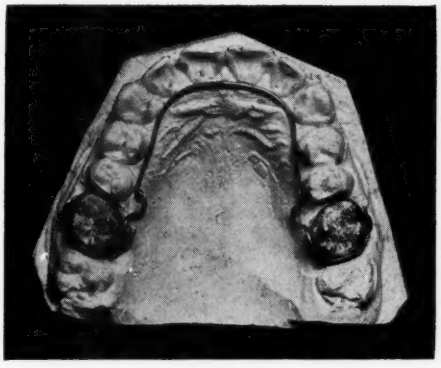

Fig. 2.

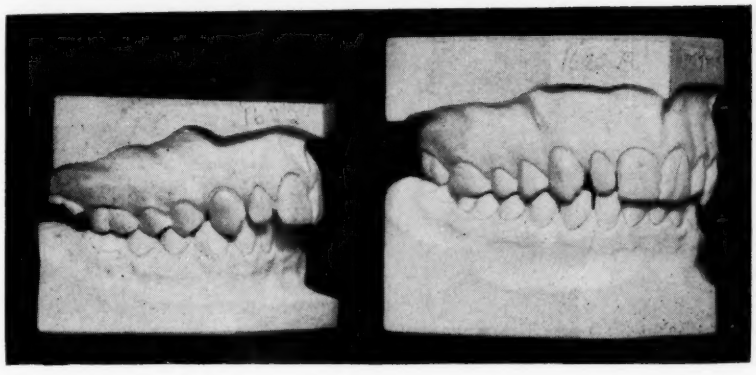

Fig. 3.

It may be interesting for us to examine a case of distoclusion in a younger child (Fig. 5). This child is eight and one-half years of age and passing through the period of transition. The task with this child is to correct the distoclusion with as little trouble, and in as short a time and with as little appliance as possible. The study of the case revealed the possibility of such a result. A lingual wire similar to the one shown in Fig. 2 was applied to the maxillary arch and manipulated in such a way as to remove the points of interference in the canine and incisal region; at the same time exercises were prescribed to be commenced as soon as the arches could be placed in the correct mesiodistal relation. Without any change of appliance whatever, and in a short period of eight weeks this child had overcome the distoclusion. After the muscles had become strengthened to what seemed a satisfactory

degree all apparatus was removed and the child continued to function in correct mesiodistal relation. Here we have demonstrated again that it is possible in many cases of similar development to overcome distoclusion with minimum difficulty for the patient.

Not very long ago some one who had had considerable experience in the treatment of malocclusion, read a paper setting forth his despair in the treatment of mesioclusion. Several cases were shown with failures, partial or complete. This as you all know is a history all too true of many cases of

Fig. 4.

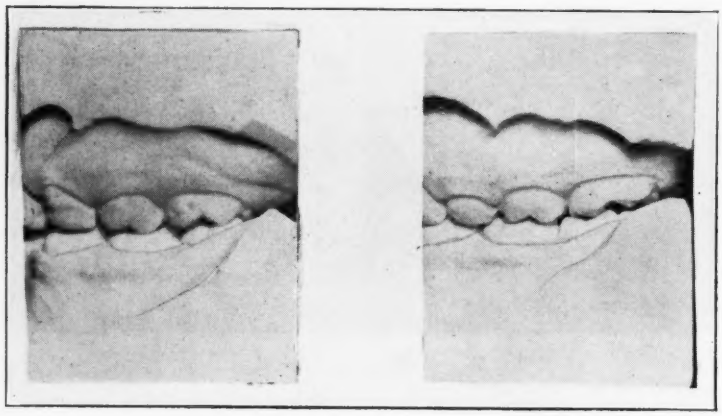

Fig. 5.

mesioclusion. It is a type considered by most orthodontists as the most trying and uncertain of favorable prognosis. I have chosen to illustrate one of these of extreme variety which is at present in the process of treatment. Fig. 6 will be seen to represent a case of mesioclusion of extreme type. This child was five years of age and should have been under treatment at least six months or a year earlier. By the use of a lingual wire on the maxillary arch and a labial wire on the mandibular arch, together with the employment of intermaxillary elastics to a point where mechanical advantage was established, the correction was made in a very short period, and has remained in this position without any form of mechanical retention during that trying

period when the anterior teeth are being replaced by the permanent ones. The advantage of the retentive features of overlapping incisors is seen to be entirely absent. To my mind the case of this boy illustrates more than any other the value of well-developed muscles at the proper period during treatment. The illustration does not begin to show the severity of this mesioclusion. Here the patient is shown about one year after the mesioclusion was corrected, still in normal mesiodistal relation without ever having any kind of retention, simply the retentive value of a strong set of muscles strengthened at the proper period. In order to emphasize this method as applied to mesioclusion let me quote from a paper written about two years ago.

"One step further will bring us to the treatment and retention of mesioclusion where the contrast between atonic and tonic muscles is a serious consideration for the orthodontist. It is essential to know that when a developing or fully developed mesioclusion is associated with underdeveloped masseter-temporal groups, it is usually a mistake to begin the development of these muscles prior to mechanical treatment. You will notice that this statement seems contrary to one made in the beginning when speaking of preliminary treatment.

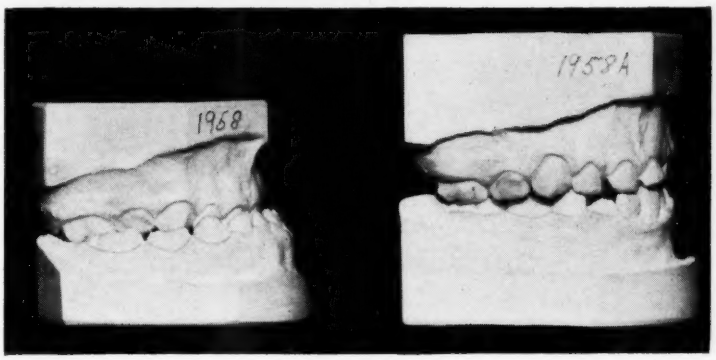


Fig. 6.

Therefore, let us grasp its significance and note the essential difference. In many cases of mesioclusion mechanical interference may come before muscular development for the very good reason that strong masseter-temporal groups offer greater resistance to mechanical treatment in the initial stages. The treatment of mesioclusion, therefore, should be carried on in the usual way with the use of intermaxillary elastics until the point is reached where the cusps are approaching their normal relationship. It is at this point that well developed masseter-temporal muscles are desirable. Prior to this their weakness is an asset. Therefore, when treating such malocclusion begin the development of the masseter-temporal group at this definite point and continue, not only until the occlusion is as near normal as possible, but through the whole period of treatment, and continue the activity of this group of muscles as a retentive measure. It will be found that in a great many instances there will be little need for retention of mechanical nature. Especially is this true when the teeth are provided with well developed cusps, and where sufficient overbite has been established in the anterior region."

The following history should be of unusual interest. In March, 1922, a patient was brought to the office with a well-developed mesioclusion. At that time the usual methods were employed with a view of carrying out the final stages of treatment and retention without the use of apparatus. When it became possible for the patient to place his arches in the proper mesiodistal relation, or in other words, in a position of mechanical advantage, the

muscles of mastication were developed and all apparatus removed from the teeth. "The work was accomplished between the first appointment after the apparatus was applied and the next appointment—a period of four weeks. When the child presented himself for his second treatment he was well on the way to recovery. The elastics were removed and further treatment was accomplished by exercise. At the end of four months the appliances were removed and the child continued muscular treatment with the result that you see in the second model of the series." (Figs. 7, 7-*A* and 7-*B*.) Three years later an examination of this patient and accurate measurements of the three models, one before treatment, one after the mesiodistal relation had been corrected and the last at the end of three years, furnish us with interesting and valuable data. By comparing the figures belonging to each set of models you will find that immediately after the correction of the mesioclusion the maxillary arch, in accommodating itself to the mandibular in the correct position, became somewhat smaller, but with continuation of the exercises

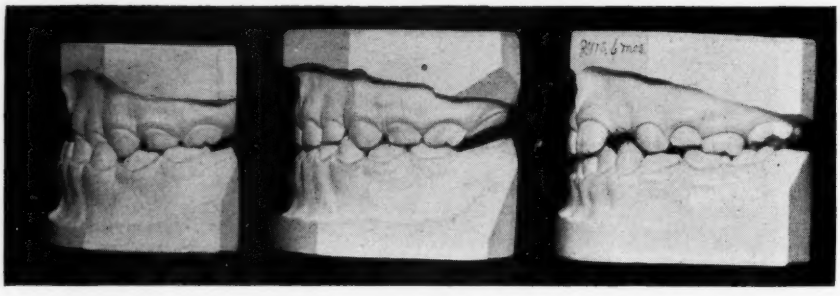

Fig. 7.

which furnished a much stronger set of muscles the development continued without apparatus, producing arches of considerably greater development. The measurements taken at the gingival border, on the lingual aspect, of the canines, first and second premolars indicate a development of from 1 mm. to 2½ mm.

TABLE I

| | BEFORE TREATMENT (AGE 4½ YRS.) | AFTER CORRECTION OF MESIOCLUSION | THREE YEARS LATER | GROWTH |
|---|---|---|---|---|
| MAXILLARY | | | | |
| Canine | 25 mm. | 24 mm. | 27 mm. | 2 mm. |
| 1st premolar | 29½ " | 29 " | 32 " | 2½ " |
| 2nd premolar | 32¼ " | 32 " | 34½ " | 2¼ " |
| MANDIBULAR | | | | |
| Canine | 21 " | 19½ " | 23½ " | 2½ " |
| 1st premolar | 27 " | 26 " | 28 " | 1 " |
| 2nd premolar | 32 " | 31 " | 33½ " | 1½ " |

Some among you may remember a reference in previous articles to the case I am now going to show you. To such the further progress in the treatment of this malocclusion should be of unusual interest. This treatment was carried on for a period by the use of a lower lingual wire only. No appliance of any nature was applied to the maxillary arch.

During this period of treatment the muscles of mastication were developed and used in a manner to stimulate a very satisfactory development. The maxillary arch received what might be termed a secondary force through

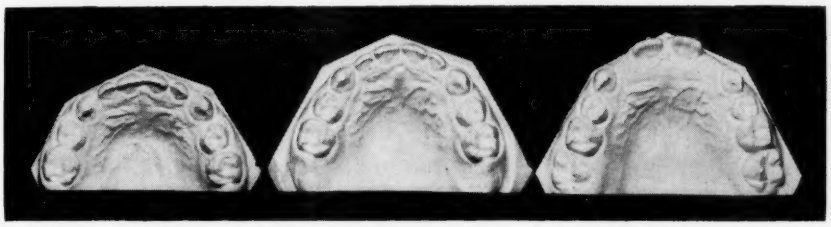

Fig. 7-*A*.

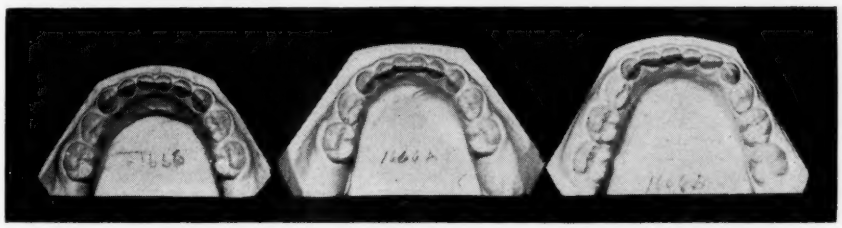

Fig. 7-*B*.

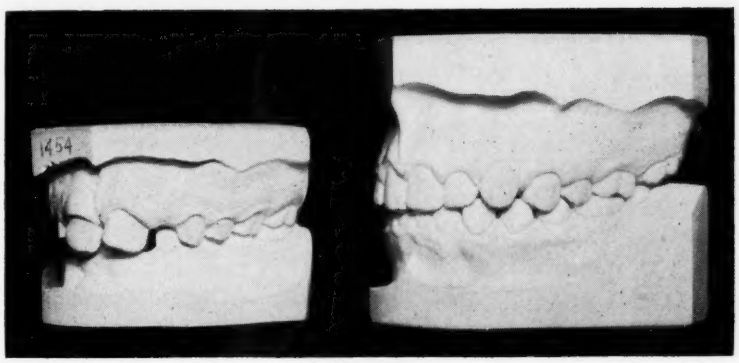

Fig. 8.

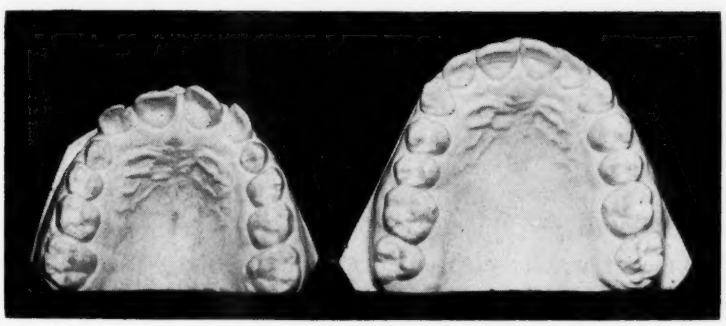

Fig. 8-*A*.

the frequent use of the masseter-temporal group in particular. Figs. 8 and 8-*A* will show you very clearly the satisfactory development that has thus far been obtained. The orbicularis oris muscle is also being exercised, and at the present time the patient is using a removable retainer with bite plane

in order to somewhat further improve the deep bite. This treatment has been of the simplest and the results are satisfactory. The patient, living at a distance, is under the necessity of visiting the office but infrequently. You must all agree that such a method of treatment is far superior to that necessitating biweekly visits and expansion arches with their labial appliances and ligatures.

I illustrated a case of distoclusion overcome in a period of a few weeks. This was of a young child. Allow me now to illustrate a case of a girl of fifteen years of age who had been under treatment for a number of years for the treatment of distoclusion. The usual methods were employed and were not successful. The case was finally dismissed without the orthodon-

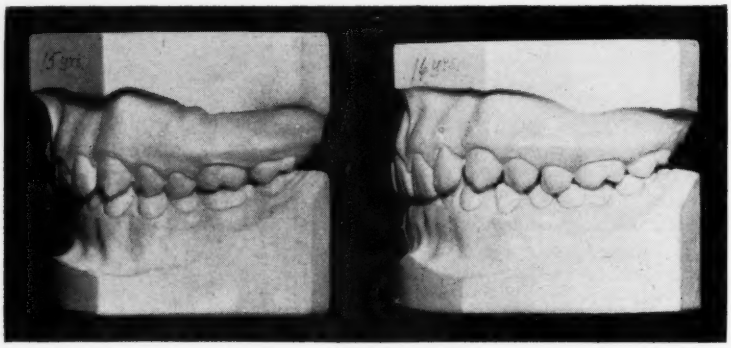

Fig. 9.

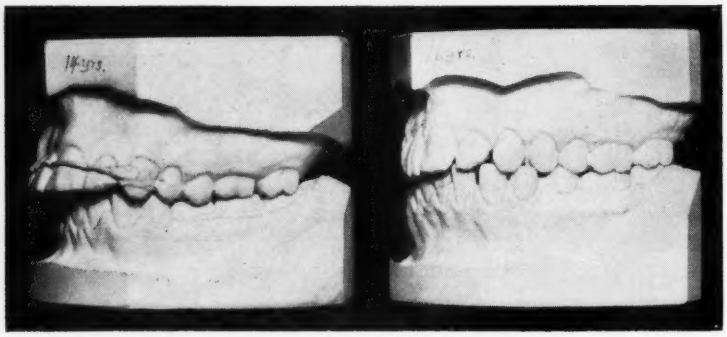

Fig. 10.

tist having reached his objective. Fig. 9 illustrates the case as first presented to me.

This case is under treatment, but it suited my purpose so well that I wanted to bring it to you just at this period of treatment. Obviously our task for this patient was to correct her malocclusion with the least difficulty, and in the shortest possible time. Being in attendance at boarding school it was imperative that her visits to the office be infrequent. The method of procedure was to first make examination discovering the points of interference. As in the case of the young child mentioned above, these interferences were removed by the use of a simple lingual wire. Following closely upon the removal of these interferences the patient was instructed to place her arches in the correct mesiodistal relation, and with the mandible

held in static position to contract and relax the masseter-temporal group a number of times morning and evening. In a shorter period than two months the mesiodistal relation was corrected and there remains only the necessity of correcting the position of the mandibular incisors. This correction will be accomplished by the use of the lingual wire. Now in order to emphasize the virtue of this method of treatment contrast the periods of time used in the two treatments, the form of appliance, remembering the successful treatment was the shorter by many months and years, that no appliances were visible, that no retention will be necessary except a lower lingual wire and the continuation of the prescribed exercises. There is no

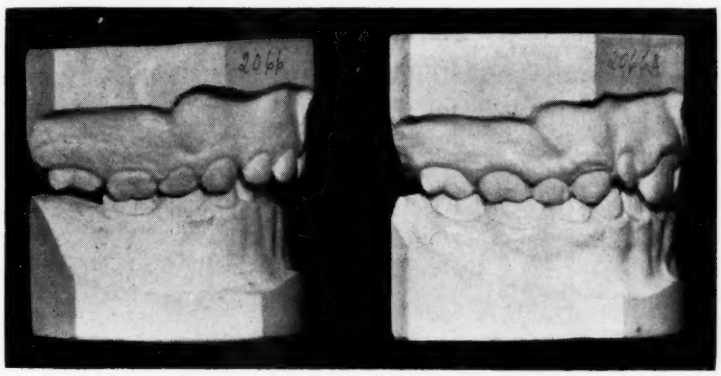

Fig. 11.

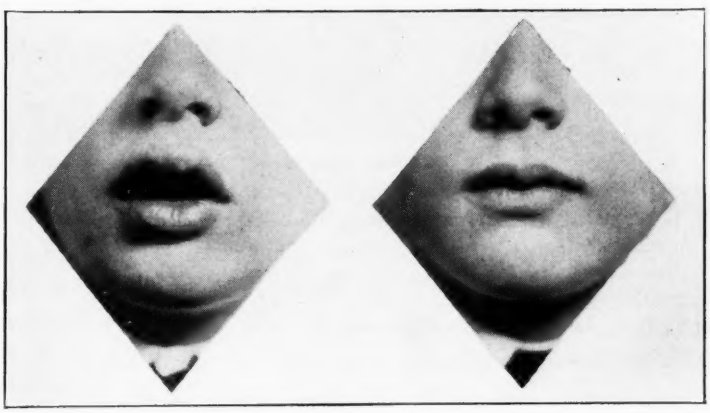

Fig. 12.

retention in this case, and I have no fear that there will be a relapse so long as this patient has a strong set of masseter muscles. Doubtless this comparison is sufficiently startling to cause the most indifferent to reflect.

In order to further emphasize the simplicity of this method of treatment allow me to show you another case that had gone through years of treatment with little satisfaction. In this case the parents decided to try a different kind of treatment. Although the patient was more or less disgusted with orthodontia in general and somewhat indifferent and careless in performing his exercises, a vast improvement was noticed over the condition when first presented. The methods used were similar to those described in the foregoing treatment; the same search for points of interference, a similar

simple method in eliminating them, the same idea of regarding placing the arches in the proper mesiodistal relation and the employment of exercises when the proper mechanical advantage and balance were possible. Fig. 10 shows the result obtained in much less time and with infinitely less trouble than it took to produce the failure it represented when first presented. I have hesitated in making these comparisons but they are only two of many, and I trust that their lessons will not be lost.

The case I am about to show you now will gain your interest on account of the fact that the treatment has been so simple, and that the results so far are so promising. The first illustration, Fig. 11, gives you an idea as to the form of malocclusion and the second illustration Fig. 12 showing the lips, I am sure, will be recognized by most of you as a case requiring something more than mere mechanical interference. Similar methods

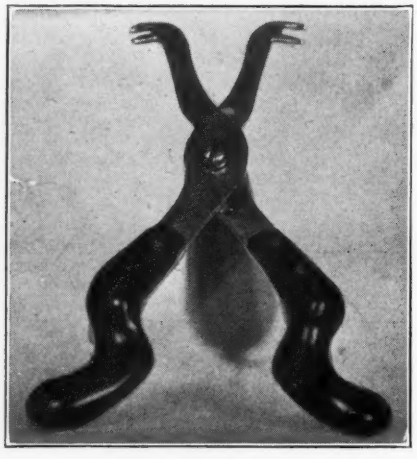

Fig. 13.

were used in this treatment. They might be described as follows: removal of interference, adjustment to a position of mechanical advantage, the exercises of the controlling forces while in the position of mechanical advantage. For the reduction of the lips the orbicularis oris exerciser has been used twice daily (Fig. 13).

The last treatment is one of a young lady of eighteen years of age whose lower lip was in such an atonic condition that the patient had slight control over its movements. The condition was a source of great annoyance and embarrassment, and the patient's family was contemplating a surgical operation in an attempt to improve the condition. Persistent and gentle exercising with the orbicularis oris exerciser has not only increased the tonicity of the muscle fibers, but at the same time the conscious control of this member has become so much improved that the patient is able now to use it with almost normal function.

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INTRODUCTION AND DISCUSSION

*Dr. A. P. Rogers.*—It gives me a great deal of pleasure, as you know, to embrace this opportunity to talk to you a little while on a favorite subject of mine.

For many years I have been much interested in, and in special sympathy with, that class of orthodontists who have recognized that our children have been "overorthodonted," so to speak. I have also been interested in the child itself. For many years I was impressed with the crudeness of orthodontic appliances and the apparent disregard for the feelings of the children, let alone the physiologic interferences taking place under the direction of some of our best known orthodontists of that day. When the work began to progress to the point where some were beginning to realize that many cases seemed to get along without treatment, it encouraged me to look in another direction and perhaps find a method of treatment that would do away with the extreme orthodontic technic, and also with the danger of too much "watchful waiting."

So my paper is going to be based upon the correction of malocclusion with the least possible use of appliances, and with the least possible inconvenience to the child in the matter of time and pain, and inconveniences of various kinds.

Dr. Rogers then presented his prepared paper entitled "Simplifying Orthodontic Treatment," illustrating with slides.

*President Howard.*—The meeting is thrown open for general discussion on Dr. Rogers' paper.

*Dr. F. A. Delabarre.*—I shall speak very briefly and solely on the question of muscular function.

I approve most heartily of the exercises and the results that are obtained from muscular exercises as outlined by Dr. Rogers.

In making our diagnosis of faces, we must not only consider the passive relations of the anatomic features of occlusion, like the relation of the mandible to the maxilla, but we must also consider functional relations, and this is what Dr. Rogers is doing when he is estimating the functional capacity of the muscles involved.

If we have a functional activity which is wrong, either in a lack of force or in direction, it also must be taken into consideration in the treatment of our cases. If it is weak, it must be strengthened. If it is functioning in the wrong direction, tending only to increase the deformity present, that direction must be changed.

In addition to the muscular exercises that Dr. Rogers has outlined and spoken of today, there are other muscles involved in the proper functioning of the occlusal apparatus, and these, to extend his treatment, are the lips, which he has spoken of as being faulty in function in the lack of muscular tone; they need not only strengthening, but they need exercise in the proper function, in the function of speaking and in the passive function that they exert in breathing. Besides that, there is the tongue, which needs controlling in many cases, particularly in those open-bite cases, where the tongue functions faultily in swallowing.

The next time you have an open-bite case, ask the patient to swallow and then before the patient knows what you are doing, quickly part the lips, and you will, I predict, in every case find the tongue thrust forward between the incisor teeth. That tongue is functioning improperly. There is also the muscular functioning of the nose, which involves in breathing, the proper functioning of the lips and of the tongue.

There is no case that passes under my hands in which there is a suspicion of mouth breathing (even the slightest suspicion of it) that is not put under breathing exercises continued over a long period of time. The patient is given an exercise card on which he records the number of exercises he does between visits. That card is brought with him when he comes to see me, and his breathing exercises are checked up.

*President Howard.*—Is there any one else who wishes to discuss this paper?

*Dr. H. C. Ferris.*—I want to commend Dr. Rogers upon the results of his work. I have been carrying on this muscle training in my practice for fifteen years, and since Dr. Rogers has concentrated his efforts I have adopted many of his methods. There is one result from the use of these exercises that I believe to be of scientific value which Dr. Rogers has not mentioned in connection with this work.

The thyroid gland and the parathyroid we know have a direct influence upon the growth of the human anatomy, particularly the maxilla and the mandible. You cannot carry out these exercises without stimulating the anterior belly, the posterior belly of the digastric, and the hypoglossus muscle. In doing so, you stimulate circulation to your thyroid gland.

I have photographic records of one particular case, a hypothyroid. It was put under glandular therapy and with the continued muscular exercise, we have reduced that hypothyroid to about one-tenth of its normal size without any surgical operation.

If we accomplish that stimulation in any one gland, according to our latest advice, we stimulate the entire endocrine ring. Therefore, we cannot help but stimulate the growth of the entire anatomy to its normal potential.

It is a finding worthy of the highest consideration, and is supported by all the recent data on the subject.

*President Howard.*—Does anybody else wish to discuss this paper?

*Dr. Robert Dunn.*—I have always been very much interested in what Dr. Rogers has accomplished, and I have endeavored to use his ideas in my own practice, but I am here to confess that I have made a failure of it. I do not know whether it is because I do not live in Boston, or because I live in San Francisco, but I would like to see Dr. Rogers come out and handle some of the children we have out west and get them to undertake these muscular exercises. Maybe there is something unusual about Dr. Rogers whereby he can get results.

I got up mainly to say in connection with the lecture of last evening that it was a most interesting one, and was somewhat along the lines in which I have been working for a number of years, and about which I will bring out something in my paper on Friday morning.

*President Howard.*—Does anybody else wish to discuss the paper?

*Dr. W. E. Lundy.*—If I remember rightly, at our last meeting in Chicago, Dr. Jackson presented some cuts and diagrams, etc., and he demonstrated satisfactorily, I thought, that the bone of the jaw (I might say the middle portion of the jaw here) was stimulated to growth in this portion, instead of the bending of the neck of the condyle, and at that time I do not know that there was any serious contradiction of that fact. I want to know if we have departed entirely from the teachings he set forth at that time.

*President Howard.*—Is there any further discussion? How about some of you younger men? I know you are interested. If there is no further discussion I will ask Dr. Rogers to close.

*Dr. A. P. Rogers, (closing).*—All I want to say is if any of you younger men or older men for that matter wish to have some instruction on how to make practical application of these exercises, I shall be very glad to give it to you, but not in this room, and not to a large number at a time. If the president or some of his assistants could arrange for a clinic in a smaller room where we can be closer together and where we can talk more intimately I shall be very glad to show you these simple things.

To those of you who do not avail yourselves of this opportunity, I might say that all you have to think of is the proper physiologic action of any group of muscles, and remember that by exaggerating that action you will probably get increased stimulation.

# REPORT OF COMMITTEE ON DENTAL NOMENCLATURE*

By L. Pierce Anthony, D.D.S., Philadelphia, Pa.
*Chairman of the Committee*

THERE are but few developments in the field of dental nomenclature to be reported this year.

The Committee has devoted some effort in endeavoring to stimulate an interest in the subject on the part of individuals and the various organizations of specialists, but with rather indifferent success.

Only one or two of the specialist organizations have committees on nomenclature, and those that exist are not particularly active. We wish, however, to commend the efforts of the committee of the Eastern Association of Graduates of the Angle School of Orthodontia in its endeavor toward improving the nomenclature of orthodontia, and we believe its efforts in time will be rewarded with beneficial results.

The Committee wishes to call attention to a rather careless tendency in the use of some words with which we are all quite familiar and which are in every-day use. We refer particularly to the use of *central, lateral, anterior, posterior, inferior, superior, upper, lower,* etc., in referring to teeth, and *cervical, gingival, lingual, mesial, buccal,* etc., in referring to tooth surfaces. These terms are distinctly adjectives and are limited in anatomic nomenclature to indicating position and direction of parts of the body and never used as nouns. These terms should always be followed by the nouns which they qualify.

In this connection, we would also mention the objection of some writers to the use of *inferior* and *superior* in referring to the teeth or parts of the head, for the reason that they would seem to imply quality, which they do in academic language, but in anatomic nomenclature they are used only in the sense of indicating position and direction of parts of the body. However, for those who prefer, *upper* and *lower* are sanctioned as synonyms.

Similar criticism may be offered with regard to the use of the expressions *elongating* and *shortening* teeth, as used in orthodontia. As a matter of fact, the orthodontist does not elongate or shorten teeth, and we would suggest that the terms *extruding* the teeth from their sockets and *intruding* or *depressing* the teeth in their sockets be used for the sake of accuracy.

We again call attention to the incorrect use of the term *premolar.* We have met several instances during the past year in which the deciduous molars were designated as premolars. This term has been sanctioned by the Committee as synonymous with bicuspid.

The Committee has received suggestions from various sources for the

*Presented to the House of Delegates, American Dental Association, Louisville, Ky., September 21, 1925.

coinage of single words to take the place of two words or a phrase designating an object or condition, as for example, *functional occlusion, traumatic occlusion, normal occlusion, alveolar process* and *pyorrhea alveolaris.* The Committee does not feel that indiscriminate abbreviation or condensation of terms is desirable because of the confusion that may arise, and therefore has not encouraged this tendency.

We offer the recommendation that *deciduous,* rather than *temporary,* be used as the antithesis of *permanent* in referring to the teeth of the first and second dentures. *Temporary* conveys a wrong impression to the layman's mind and one that may easily prove harmful.

We would like to revise the definitions offered last year of *focal infection* and *oral focal infection* by submitting what we believe to be clearer and more precise definitions, with less liability of misunderstanding. We also present definitions of the terms *impacted* teeth and *unerupted* teeth, for the reason that there seems to be a general misconception of these conditions, many considering them to be the same condition.

In order to clear up some of the present confusion in the use of the word *dentition,* which now is used to mean the process of eruption of teeth, the teeth as a whole, the dental arches, etc., we offer *dentition, denture,* and *dental arch* to designate these objects and processes with more specificity.

We are pleased to note that the *U. S. Pharmacopeia,* tenth edition, has recommended a return to the use of the abbreviation *cc.* for cubic centimeter rather than *mil* as formerly proposed.

The Committee would recommend the adoption of the simplified cusp terminology devised by Osborne and approved by comparative anatomists some years ago. These terms we have included in our list of recommended words.

We also recommend a more general use of the classification of caries according to degree as has been in use for several years.

Further expression has been given to the opinion that the various specialties should be represented on the Committee, but aside from the objection to such a large committee, we feel that as good and better results may be obtained by cooperation between the various committees representing specialties and a general committee composed of men who are in close contact with all phases of dental practice, and who should be able to inject into the nomenclature a broad and liberal interpretation and spirit.

We are pleased to note that the efforts of the Committee have been quite sympathetically received and approved by the profession generally, and our only regret is that the demands on our time in other activities prevent us from devoting as much time and attention to this subject as we should like to give it.

We would again solicit the cooperation of committees of the various specialties, as well as of individuals, to the end that we may continue to improve and enlarge our nomenclature.

In closing, the chairman desires to thank the members of the Committee for their hearty cooperation in the work.

LIST OF WORDS RECOMMENDED

**absorption.** (L. *ab,* from + *sorbere,* to suck.) The taking up by the tissues of fluids originating outside the body; distinguished from resorption.

**aclusion.** (Gr. *a,* not + L. *claudo,* to close.) A term to express the opposite of occlusion.

**apertura.** (L.) An opening.

**arcus.** (L.) Arch.

**area.** (L.) Anatomically used to indicate space, a portion of tissue or organ, or surface.

**atrium.** (L. hall.) An entrance; the point of entrance of bacteria in an infectious disease.

**caries of the first degree.** That in which the enamel alone has become decalcified, the disturbance being limited to the enamel rods.

**caries of the second degree.** That in which the enamel and dentin have been affected, the pulp as yet not being involved, the latter being protected by a sound layer of dentin.

**caries of the third degree.** That in which the carious process has penetrated to the extent of exposing the pulp, the pulp still being covered by a thin layer of carious dentin.

**caries of the fourth degree.** That in which the pulp has undergone putrefactive decomposition, due to the ingress of microorganisms concerned in the process of decay.

**check-bite.** Term applied to a sheet of hard wax or softened modeling compound placed between the teeth (either natural or artificial), in central, lateral or protrusive occlusion and used as a check on the teeth in the articulator.

**dental arch.** The arrangement of the teeth.

**dental cyst.** So called because it is almost invariably attached to a tooth root, beginning as an epithelial proliferation in the periodontal membrane.

**dentition.** (L. *dentio,* to cut teeth.) The process of eruption of the teeth.

**denture.** The natural teeth collectively.

**artificial denture.** The artificial substitute for a full or partial set of teeth.

**focal infection.** A localized infection in some part of the body from which the microorganisms or the toxins are from time to time carried to other regions to produce other local or general systemic infection.

**impacted tooth.** A tooth fixed in such a position as to prevent its eruption.

**line.** (L. *linea.*) This term has been adopted in anatomic nomenclature to take the place of ridge, as the mylohyoid line, instead of ridge as formerly. We recommend its adoption.

**medial, median.** (L. *medius,* middle.) Synonymous with mesial.

**multilocular cyst.** An adamantinomatous cyst from epithelial remnants of the enamel organ.

**mylohyoid fossa.** To be used in indicating the area back of and below the mandibular molar into which wing extensions of lower artificial dentures are anchored.

**neoplasm.** (Gr. *neos,* new + *plassein,* to form.) Preferable to tumor.

**neoplastic tissue.** Tissue composing a neoplasm.

**occlusion rims.** The raised portions of an occlusion model or bite.

**oral focal infection.** A focal infection in the mouth from which microorganisms or their toxins are from time to time carried to other regions to produce other local or general systemic infection.

**pathohistology.** Preferable to histopathology.

**parodontosis.** (Gr. *para,* about, near + *odous,* tooth + *osis,* condition of disease.) A diseased condition of the tissues about the teeth.

**periodontosis.** (Gr. *peri,* around, next to + *odous,* tooth + *osis,* a state or condition of disease.) A diseased condition of the periodontal membrane.

**radicular.** (L. *radix,* root.) Pertaining to a root.

**resorption.** (L. *re,* back + *sorbere,* to suck.) The taking up of products or tissues originating in the body.

**supraperiosteal.** Outside of or above the periosteum.

**torque.** (L. *torquere,* to twist.) Verb: The twisting of a piece of metal so that it will exert force by virtue of its elastic reaction. Noun: The twist in metal which imparts to it the potentiality of force.

**unerupted tooth.** Tooth lacking the physiological *vis a tergo* to cause its eruption, as distinguished from an impacted tooth.

**protocone.** (Gr. *protos,* first + *konos,* cone.) The mesiolingual cusp of the maxillary molar teeth.

**paracone.** (Gr. *para,* beyond + *konos,* cone.) The mesiobuccal cusp of the maxillary molar teeth.

**protoconid.** The mesiobuccal cusp of the mandibular molar teeth.

**metacone.** (Gr. *meta,* beyond + *konos,* cone.) The distobuccal cusp of the maxillary molar teeth.

**hypocone.** (Gr. *hypo,* under + *konos,* cone.) The distolingual cusp of the maxillary molar teeth.

**metaconid.** The mesiolingual cusp of the mandibular molar teeth.

**hypoconid.** The distobuccal cusp of the mandibular molar teeth.

**hypoconulid.** (Gr. *hypo,* under + L. *conulus,* a small cone.) The distal cusp of the mandibular molar teeth.

**entoconid.** (Gr. *entos,* within + *konos,* cone.) The distolingual cusp of the mandibular molar teeth.

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# DOES BONE FORM FROM OSTEOBLASTS OR FROM A METAPLASIA OF THE SURROUNDING CONNECTIVE TISSUE?*

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## II. POSSIBILITIES FOR BONE REGENERATION FROM METAPLASIA OF THE CONNECTIVE TISSUE[1]

In the first part of our paper we have endeavored to show that the metaplasia of the connective tissue into bone has very little to do with regeneration. As a result of our experiments we have come to the conclusion that under certain conditions (damage to the osteoblastic tissue or its circulation), scar tissue develops out of the pre-osteoblastic tissue of the periosteum, or marrow and endosteum, and therefore a pseudo-arthrosis results. If these traumas are not present, out of this same tissue, cartilage, osseous and bony tissues are developed as a regeneration. On the other hand, we have come to the conclusion that in bone regeneration metaplastic bone building by the connective tissue does not take place. From the practical standpoint there are different viewpoints; while most authors, as a result of clinical and experimental experience with bone transplantation, use living bone with retained periosteum, marrow and endosteum, because in this way alone, on account of its osteoblasts, it heals in and forms a living substitute, there were earlier investigators and some today who used dead or inorganic material. They argue that to a certain extent, through metaplasia of non-specific connective tissue of the vicinity a bony substitute of the dead may be obtained to serve as a beginning. Marchand, Barth, and Lexer were the first to use dead bone and bone ash, experimentally and clinically, in transplantation and treating fractures. Marchand went a step further, and used the different elements of the bone which were synthetically prepared. The use of such synthetic preparations of the elements of the bone has been experimentally and clinically investigated recently by Cotton. Marchand and other older investigators limited themselves, for the most part, to the use of calcium carbonate and calcium phosphate. Cotton uses, in addition, urine salts, or their chemical equivalents, and also magnesium and its salts in transplantation and in the treatment of fractures (delayed union of fractures). The injection of insoluble calcium salt, according to Cotton, offers the best outlook, while the practical worth of magnesium and its salts is limited, for, because of the changing of the magnesium in the tissue, hydrogen is liberated, which damages the tissue. Cotton has successfully used the synthetic preparations he advocates.

*Translated by Erwin R. Schmidt, B.A., M.D., F.A.C.S., Chicago.

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All these materials—living, dead bone, elements of bony tissue, synthetically prepared salts of bone—are used in bone formation through the activity of the osteoblasts. As several authors maintain, these materials should at the same time stimulate the non-specific connective tissue by a metaplasia into bony tissue. Advocates of the metaplasia theory with reference to bone formation are: Ollier, Orth, Gruber, Basckkerziew, Petrow, Nemilow, Nageotte, Régard, Bancroft, Weidenreich, Simon, Ferrarini, and others. Under no consideration can absolute proof for such statements be taken from cases in human pathology, as Gruber has done, because in such cases (myositis ossificans, parosteal callous formation) the beginning of the bone building from the periosteal covering of the neighboring bone has never been with certainty excluded. In the same way transplantation experiments of macroscopic pieces of living bone freed from periosteum, marrow and endosteum, into the soft parts such as Basckkerziew, Nemilow, and Petrow performed, can never give conclusive evidence that bone formation in such experiments is due to a metaplastic function of surrounding connective tissue, because on such implants there are attached everywhere living osteoblasts (Wehner, Rohde). Metaplastic bone formation from the connective tissue of the vicinity is less open to suspicion in experiments in which the bone to be transplanted is killed before transplantation. An additional necessary condition is that the bone transplanted into soft tissue should be separated by a sufficient thickness of undamaged tissue from any osteoblastic tissue of living bone or cartilage.

Of all the investigators who transplanted bone ash, especially burned bones, into the soft parts (Barth, Morpurgo, Martin, Pockhammer, Basckkerziew, and Petrow) Barth alone found, in one of his experiments after putting bone ash intraperitoneally in a cat, bone formation in the peritoneal cavity. After transplanting boiled bone into soft tissue Sultan, Axhausen, Basckkerziew and Petrow, Régard and Haas never found bone formation. The negative result of their experiments led Basckkerziew and Petrow to believe that the dead bone, in addition to the loss of power of regeneration by the different bony tissues, had lost the property to incite an osteoblastic stimulus upon the connective tissue of the vicinity. Polettini and Christophe on the contrary are of the opinion that substances are present in bone before fixation in alcohol and boiling which can incite the connective tissue to form bone through metaplasia.

With these necessary prerequisites for experiments of this kind in mind (see previous explanation), we performed experiments to see if bone formation could take place from connective tissue of the soft parts through a metaplasia in the vicinity of a piece of dead bone transplanted into the soft parts. Keeping these prerequisites in mind, especially the fact that connective tissue in the vicinity of bone in the presence of severe damage to muscle tissue or infection, takes part in bone formation, our experiments on animals were so conducted. The implantation area (back muscles, abdominal muscles, chest muscles, upper arm muscles, muscles of the calf of the leg, temporal muscles, tendons, abdominal fascia, subcutaneous tissue) into which the dead bone was to be transplanted, was more or less damaged through tearing and crushing so that necrosis of the muscle resulted. In another series of experiments the

area of implantation was infected at the same time, in that the dead piece of bone was contaminated by the skin of the animal. For implantation, a piece of diaphysis 1 centimeter long was taken from the ulna or radius, or a piece from a rib, and killed in different ways. In the first series of experiments, the pieces of bone were boiled 10 minutes, then allowed to cool, and implanted into the soft tissue of the same animal after they had been infected by the skin. Because boiling of the bone is a coarse and unnatural killing of the bone, in a second and third series in which the bone to be transplanted, according to our view, should have no living cells transplanted with it, we kept this bone outside of the body 14 days after its removal. In this time the ability of the cellular elements to live and to proliferate is lost; bone formation as a result is with certainty excluded. The implantation material (bone with periosteum marrow and attached pieces of muscle) was removed sterile, and either kept 14 days sterile outside of the animal body in a reagent glass, excluding the air and without adding any fluid or other material, in its own tissue juices at a temperature of 6 degrees Celsius (series of experiments No. 2), or under similar conditions in an incubator at 37 degrees Celsius allowing autolysis (series of experiments No. 3). The material prepared in this way, at the close of its preparation, was tested bacteriologically, and only the bones found to be sterile were implanted in the soft tissues of the animals from which these implants were taken 14 days before.

In the sterile cold preparations, there were no gross changes outside of the loss of life of the cells. In the preparation where autolysis had taken place (keeping temperature at 37 degrees) there was a process similar to catabolism in the tissues. The products of destruction, which formed during the time the tissue was kept outside the body in both cases, were present in a small amount of serum, and were in every case taken into account by transplanting this serum with the bone.

This catabolic substance must be considered and its rôle determined in estimating the metaplastic bone building power of the connective tissue, as these sera are the carriers of the reactive and reparative processes in all healing and inflammatory processes.

Furthermore on the advice of Herr Geheimrat Aschoff, director of the pathological institute of the University, who examined our preparations and substantiated our findings, transplantation experiments with masses of tissue were begun. As is well known on metaplastic grounds these lead to heterotopic bone formation. As suitable experimental material, the caseous chalky masses of calcified tuberculous glands from the hilum of a human corpse were taken out sterile at postmortem, and kept for 14 days at 6 degrees in a reagent glass with the air excluded. At the end of this period, the material was tested for sterility, and that found sterile was implanted into the soft tissues of the animals. In these experiments no great gross changes took place during the time the material was kept outside the body, except the destruction of life in a few cells.

While in these experiments organic and inorganic parts of bone were transplanted, in a fifth series of experiments only the inorganic constituents were transplanted (burned bones of the same animal). We did not transplant

synthetically prepared inorganic or organic elements of the bone or decalcified bone. Because in our experiments we never found that bone developed in either autogenous bone, bony elements or other masses developed in the living body which have a tendency to metaplastic bone formation, so bone development is not to be expected from synthetically prepared bone or decalcified dead bone.

After this material, which is prepared beforehand in one way or another, is implanted into the heavily traumatized and damaged muscles, fascia, tendons or subcutaneous tissue, the soft parts were sutured together over the implantation. At different intervals the material, including the surrounding soft parts, was removed and studied.

As experimental animals we took rabbits, cats, and dogs so that we might have several species of animals and thus obtain unbiased results. Rabbits, as other investigators have established, are especially suited for bone experimentation, and there appears very quickly in the damaged muscle dystrophic calcification of the muscle bundles which spreads rapidly. With this there appears a condition, which in the pathology of heterotopic bone formation very often precedes the real bone formation, and in many cases helps to begin bone formation. In our rabbit experiments we have, as a result of the spontaneous appearing calcification of muscle bundles, extraordinarily favorable conditions, which imitates in a surprising way the natural bone formation of many cases of heterotopic bone formation.

If in any way a metaplastic bone formation takes place experimentally in the connective tissue of the muscles, of the fascia, of the tendons, or of the subcutaneous tissue, it must develop in those experiments which nearly approach the normal development. Because the activity of the osteoblast is less in older animals, we have used only young growing animals.

The results of our experiments will be given before we go further into the discussion. Under the conditions set down for our series of experiments, there is no metaplastic bone formation within an observation period of 5 months, by the connective tissue of the muscles, of the fascia, of the tendons, or of the subcutaneous tissue when dead pieces of bone of the same animal, or a spontaneous developed dystrophic chalk mass are used. In the second and third series of experiments the material kept outside of the body with the extruded serum and its catabolic substances has produced no bone forming processes in the area in which they were implanted. At the end of our observation time (5 months) the cellular tissue of the host has completely disappeared. In a tough, wide, connective-tissue covering, the bone is encapsulated like a foreign body, without attaining a more intimate union with the tissue of the host. The tissue of the host grows around and through it, just as in porous foreign bodies (sponge or coal). From the third month on, just as the histological studies show, the process of healing-in is to be regarded as finished. By this time the dead transplant, to a certain extent, has been separated from the general body tissues by a tough wide tissue poor in nuclei (Figs. 25 and 30). It is certain that observing for a longer time would show no change in the metaplastic ability of the connective tissue to form bone, because from the third month on, we have to do with a closed process, and with a transplant

completely encapsulated by scar tissue not able to react. Under the conditions set down for our experiments, we can conclude that there is no bone formation from the nonspecific connective tissue. Not once does the attempt at imitation of the stimulus, traumatic or infective, given so often as the cause of growth in the pathogenesis of connective-tissue formation in muscle, result in bone formation. Indeed, the spontaneous appearance of calcification of muscle bundles in the rabbit does not give the slightest ground for believing that bone-building processes take place but disappear again after several weeks through resorption.

The microscopic picture of boiled bones (Figs. 21 and 25) in all stages shows a remarkably sharp-edged contour of bone, bound to the surrounding tissue by a sharp, somewhat spread out border, without any sign of gradual

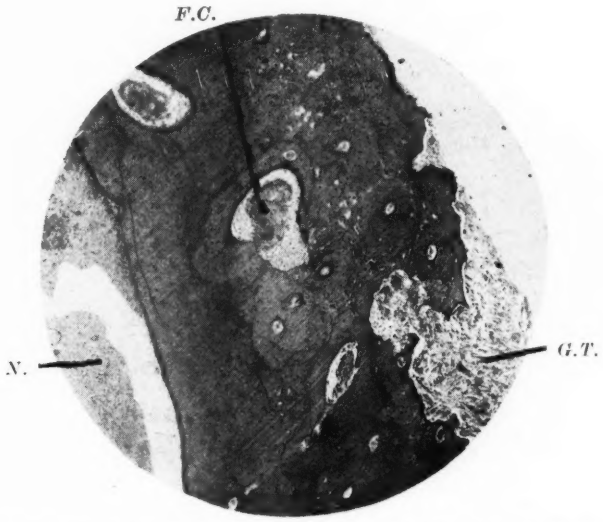



Fig. 21.—Implantation of a boiled infected piece of bone into the muscles of a young cat. After 6 days we find dead, sharply defined bone with fibrin, *F.C.*, growing into the marrow spaces, *N.*, with young granulation tissue, *G.T.*, on the outer surface but with no development of this tissue into osteoblasts; and no bone-building processes.

transition from one to the other. The union of the surrounding tissue with the bone takes place very slowly; first, through the deposition of fibrin from the surrounding tissue (Fig. 21) and then by replacement of the fibrin by round cells and fibroblasts (Fig. 22), and this union from beginning to end (loose scar tissue) remains extraordinarily loose. Furthermore, it is characteristic that the granulation tissue grows very slowly into the extraordinarily long retained marrow necrosis areas found in the marrow spaces and canals. Slowly are these replaced by granulation tissue and remain to the last as necroses of the marrow. At the same time it is worth mentioning that the bone cells stain well and that their dissolution is gradual. With reference to the marrow cylinder with its well retained ability to take up stain, as well as to the bone cells, the microscopic study shows with definiteness that these are dead protoplasma masses and through cooking presents a fixed picture—irregular pointed contours of the cells and nuclei, shrunken and deep, dark stained nuclei.

The fixed cylinders of necrosis lying in the marrow canals, and also the

bone cells, have shrunken together toward the center of the canal, and in this way have lost contact with the bony wall (Fig. 21). The vessels and cell masses of the fixed necrotic cylinder of marrow lie in a light rose colored homogenous mass in a hæmatoxylin eosin preparation (Fig. 21). These fixed cell masses even in the oldest preparations never show any evidence of life. As previously explained, they are gradually resorbed by the granulation tissue of the host, which creeps in. Even the fixed bone cells never show any division of the nuclei; the dissolution of the nuclei takes place slowly. These conditions depend upon the fact that through boiling, a protoplasmic substance (fibrin) develops, in which the dead cells are fixed and included. As corks, these masses stop up the marrow spaces and bony canals, and make difficult the creeping in of the granulation tissue and retard the splitting up and dissolution of the included cells and cell nuclei. This is the reason for the slow appearance and incomplete union remaining between bone and host. For the

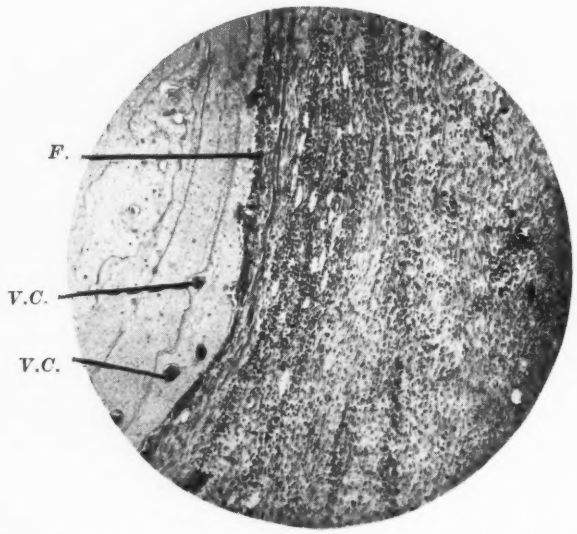



Fig. 22.—Implantation of a boiled, sterile piece of bone into the muscles of the back of a young rabbit. After 9 days we see dead, sharply outlined bone, *V.C.*, new vascular canals, near the periphery and there is a thick covering of fibroblasts, *F.*, but no new bone-building processes. There is a capsule-like formation around the bone.

same reason, the resorption of bone is small and is evidenced only in the form of small lacunar erosions (Fig. 24). The giant cells which, together with the other cells of the granulation tissue, take part in the erosion, are smaller than osteoclasts and seem identical in figure and form with the usual foreign body giant cells. In those late cases, in which the bone is encapsulated as a dead porous foreign body and scarcely permeated by the tissue of the host, the bone is very brittle and on sectioning with the microtome falls apart into its lamellar system (Fig. 25).

Several findings which are important in the question of metaplasia and could lead to an incorrect diagnosis must be explained. In the first weeks, especially in those cases not disturbed by infection, the granulation tissue pressing toward the bone, attaches itself to the bone with its fibroblasts and forms a cellular layer lying on the bone (Fig. 21). Under the stimulation of

the bone there develops here, as Figure 22 shows, an active nuclear division of the fibroblasts, so that the nuclear content of the tissue on the outer surface of the bone is greater than at a greater distance from the bone. By superficial study of these fibroblasts standing close together on the outer surface of the bone, we might consider the connective tissue cells as changed into osteoblasts, especially in those places where these masses, rich in cells, on the outer layer of bone sink into openings of the haversian canals (Fig. 22). However, after careful study, there is not the slightest evidence to show that they are osteoblasts. These cells always retain their small, spindle form figures; their small spindle-like and dark nuclei, never take the vesicular form (also larger) of the osteoblasts with their large, round, and slightly colored nuclei. They lie perpendicular at first (Fig. 21) and from the eighth day on, parallel to the outer surface of the bone (Fig. 22) and never lose their fibrillary structure (formation of delicate connective tissue fibers). Nowhere does a meta-

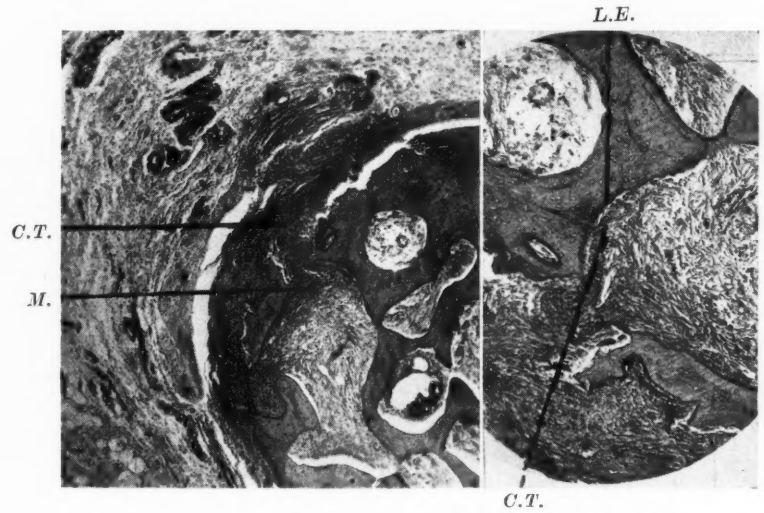



Fig. 23 Fig. 24.

Fig. 23.—Implantation of a boiled piece of bone into the abdominal muscles and fascia of a young dog. After 32 days we see dead, sharply outlined bone, surrounded by a network of fibrous connective tissue, *C.T.*, which wanders into the peripheral marrow spaces, *M.* There is no change into osteoblasts, and no bone-building processes.

Fig. 24.—Higher magnification of section from Fig. 23, showing lacunar erosion, *L.E.*, of the dead bone by the connective tissue, *C.T.*, of the host.

morphosis of the cells develop. From the fifth week on the multiplicity of cells, which comprise the fibroblastic layer clinging to the bone, disappear (Figs. 23 and 24), so that immediately on the bone there is a fibrillary connective tissue which becomes poorer and poorer in cells, and finally the bone is covered by a dense scar tissue (Fig. 25).

In preparations up to 3 weeks, there are seen the homogenous masses, previously described, between the dense fibroblastic layer on the outer surface of the bone, which is the hæmatoxylin eosin preparation. These masses are colored light rose color (Fig. 21). With a longer period of observation these masses are more and more replaced by the fibroblasts (Fig. 22). These same homogenous masses, as previously explained, are also found in the marrow spaces and bony canals (Fig. 21). They present toward the center of the

canal shrunken fibrin, cell and blood masses of the marrow and its capillaries. By superficial examination, it is possible to regard these as young osteoid cells. Careful investigation, especially the presence of fibrin shown by staining after Weigert and Kockel, show these masses to be simply fibrin, while the cells are either living fibroblasts of the host, or else are shrunken dead cells of the marrow. In these preparations there is the usual fibrinous deposition from the host, or fibrinous masses which, on account of boiling of the transplant, have fallen out of the marrow. These deposits of fibrin are rapidly replaced on the outer surface of the transplant, inside the bone later, and then only slowly by the tissue of the host. The preparations under consideration are the same as one sees in the healing-in of foreign bodies, especially when it concerns porous bodies, as long as the healing-in process is associated with marked exudative processes and marked reaction of the tissues of the host.

We have already mentioned, that, in the other series of experiments bone formation never occurred, but that the *implants* of these experimental series are encased by the tissues of the host as foreign bodies by firm masses of connecting tissue (Fig. 30). The processes of healing-in take place, for the most part, as in the case of the boiled bones. A detailed description need not therefore be given; the reader is referred to the explanations given above. On the other hand, the differences which came to light in the various experimental series, with regard to the processes of healing-in, must be more exactly indicated.

The boiled bone fragments still display, up to the third month, quite extensive preservation of their nuclear staining (shriveled bone corpuscles and medullary cells) which result from a fixation caused by the boiling. In contrast to this, control experiments before implantation of the bone fragments which are preserved cool, show that the various cell-varieties of the bone have lost nothing in their form and capacity for staining through preservation, with the exception of the periosteal covering and the immediately adjoining bone corpuscles. Somewhat greater changes appear in the bones subjected to autolysis, in that the staining power of the cell nuclei has somewhat diminished, and in the marginal portions of the bone in greater measure than in the case of the pieces which have been preserved cool, empty bone spaces or bone spaces with pale nuclear shadows occur. In both cases (bone preserved cool and autolyzed) the attached muscle fibers are swollen, without nuclei, the fatty tissues dull, the erythrocytes pale. Thus, in neither case has any decomposition of the dying cell and nuclear masses of the actual bone tissue taken place. This rests upon the fact that the tissue fluidity necessary to decomposition is almost lacking.

If now the bone fragments are replanted in the living bodies of animals, changes very quickly set in. In bones which have been preserved cold, we find the bone spaces, after a fortnight passed in the living body of an animal, completely empty, while in autolyzed bones they are still partly filled, after the same length of time has elapsed as in the cool preserved bones, with nuclear shadows, which, in individual cases, persist up to the fifth month as scarcely recognizable shadows in small splinters of compact bone. In both cases (bone preserved cool, and autolyzed) the periosteal tissue and endosteal tissue

have completely disappeared after 14 days, while the marrow tissue is still well preserved, in so far as its structure is concerned, but greatly bleached in so far as is concerned its color. To the last, necrotic fat remnants of the marrow and the surrounding soft portions persist, as they plainly present greater difficulties to the surrounding tissue in their assimilation as a result of some sort of coagulation processes or decomposition products. The surprisingly quick destruction of the nuclei, which were still well preserved before the implantation, is a result of the contact with the tissue fluid, which in the living body continuously flows about and through the implantation and thereby makes possible the breaking down of the cells and nuclei.

As to the reaction of the surrounding tissue, we have mentioned the fact that, in the case of the boiled bone fragments, the invasion of host tissue takes place only slowly and in small measure; exactly the same thing is true in the case of the transplantation experiments with calcified masses (Figs. 31 and 32). In contrast to this the autolyzed bones (Figs. 28 and 30), and especially with the bones which have been preserved cool (Figs. 26 and 27) a very swift and very abundant penetration by the tissue of the host takes place. This is due to the fact that the boiled bone fragments from the beginning resist the opportune access of the tissue fluid as a result of the closing of the bone spaces and small canals by coagulation products (the result of boiling); and for the same reason, because of the obstruction of the little canals, the cellular elements of the host can press forward into the boiled bone fragment only with difficulty. Thus they offer greater resistance to the host, and for that reason the encapsulating processes resulting from their influence as foreign bodies naturally manifest themselves in these cases in the form of early appearing bundles of connective tissue. The poor breaking down of the necrotic nuclei of the boiled bone fragments is related to the same processes.

In the cool preserved and autolyzed bones, no similar closing of the marrow spaces by coagulation products takes place. Consequently, they are more quickly penetrated by the tissue fluid and the cellular elements of the host, with the result that there is a more highly developed relation between *the transplant* and the host. Upon similar grounds, the absorption processes in the case of the cool preserved and autolyzed bone fragments are more strongly marked and are accompanied by a richer development of the giant cells. But in any case, with all transplants, the absorption processes remain unimportant and are soon exhausted, so that at the close of the period of observation, in all cases, a bone only slightly eroded lies encased within a firm mass of connecting tissue poor in nuclei.

In the case of calcified masses (Figs. 31 and 32) there are more pronounced encapsulating processes, in the form of fibrous formations, than with the bone fragments which have been preserved cool or autolyzed. An invasion of cells from the host does not take place. The calcified masses are not decomposed, but only on their periphery attacked to a limited extent by giant cells forming small lacunar erosions (Figs. 31 and 32) and encased as foreign bodies.

The porous carbon masses of charred bones (Fig. 33) permit a swift penetration of their hollow spaces on the part of the tissue fluid and the cell masses of the host. However, no inner union with the host takes place here either,

only a slight definite erosion of the bone, early and marked encasing-processes (formation of fibrils), and finally the imbedding, in a firm fibrous mass.

While the absorption processes in the bone in all the various series of experiments occur only to a limited extent, and appear as small lacunar erosions, there are, nevertheless, differences in the absorption processes, depending upon

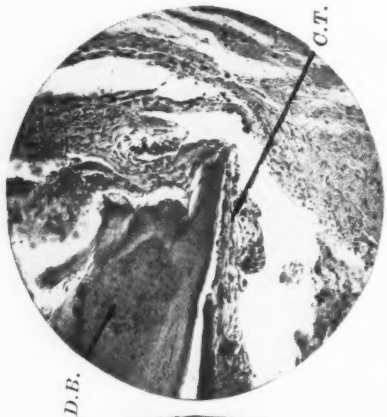



Fig. 27.

Fig. 26.

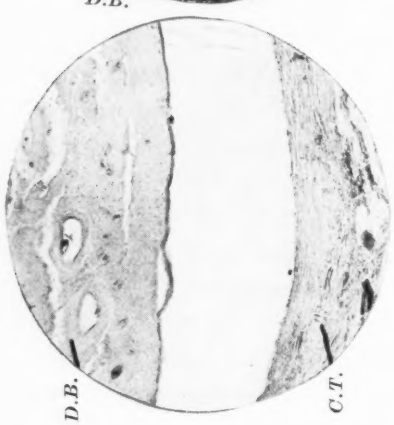



Fig. 25.

Fig. 25.—Implantation of a boiled, sterile piece of bone into the musculature of the back of a rabbit. After 3 months we find dead, sharply outlined bone, *D.B.*, permeated by fracture lines. The connective-tissue capsule, *C.T.*, shows no change into osteoblasts and no bone-building process is evident.

Fig. 26.—Implantation of a piece of bone kept sterile for 14 days without infection, into the adductors of the thigh in a young rabbit. After 14 days we find dead bone with empty spaces, *D.B.*; concentrically arranged granulation tissue, *G.T.*, of the host, without evidence of any change into osteoblasts and no bone-building processes.

Fig. 27.—Implantation of a piece of bone, which was kept cold and sterile for 14 days without infection, into the abdominal musculature of a young rabbit. After 2 months, we find a dead bone, *D.B.*, surrounded by a capsule of connective tissue of the host, rich in cells, *C.T.*, with no change into osteoblasts and no bone-building processes.

whether we are dealing with large, small, or very small bone fragments. The cellular reaction, especially the number of giant cells, is notably greater around small splinters (Figs. 26 and 32) or the points of jagged pieces (Fig. 27), penetrating far into the tissue; it continues longer, and results in stronger erosion processes in the implants than around large, especially compact, pieces and in the case of the surfaces of smooth bone fragments (Figs. 28, 29, 31 and

33). Furthermore, the formation of excluding bundles of connecting tissue sets in later around the small splinters or the penetrating points of bone than around large pieces of bone and flat surfaces.

Thus we arrive at the law, that the smaller the implant, or the more irregular its surface, the stronger are the cellular reaction and absorption proc-

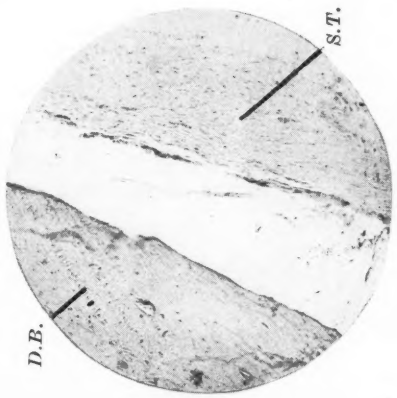



Fig. 30.

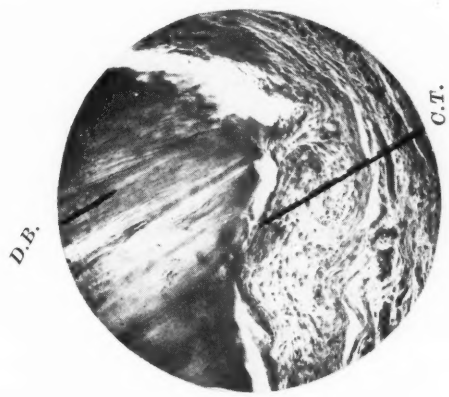



Fig. 29.

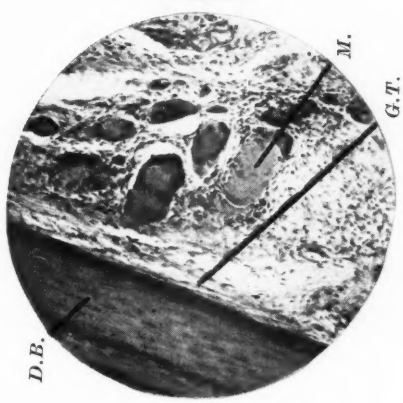



Fig. 28.

Fig. 28.—Implantation of a piece of bone, which was allowed to autolyze for 14 days without infection, into the flexor muscles of the upper arm, in a young rabbit. After 14 days, we find dead bone, *D.B.*, surrounded by granulation tissue, *G.T.*, of the host, rich in cells with no change into osteoblasts and no bone-building processes. *M.*, Remnant of muscle.

Fig. 29.—Implantation of a piece of bone autolyzed 14 days without infection, into the muscles of the lower leg of a young rabbit. After one month we find, *D.B.*, dead bone, surrounded by fibrous connective tissue, *C.T.*, of the host in concentric arrangement, with the development of osteoblasts and without bone processes.

Fig. 30.—Implantation of a piece of bone autolyzed 14 days, into the temporal muscles of a young rabbit. After five months, we find dead bone, *D.B.*, separated from the capsular tissue, *S.T.*, of the surrounding tissue. There is no development of osteoblasts and no building processes present.

esses, and the longer do they continue. This has its cause partly in the fact that small splinters, or jagged bone-points, produce in the host a stronger traumatic irritation than the smoother surfaces of larger pieces of bone. In the main, however, the difference may be ascribed to the fact that small bone fragments, or jagged bone-points, have a relatively greater surface than large smooth pieces, and that therefore, corresponding to the greater surface extent

of the former, the resorption processes are stronger here than in the case of the large, smooth implants with their relatively small surface. However, the possibility remains that small bone-splinters can be resorbed by non-specific connective tissue; in larger bone-fragments, however, the resorptive power of the

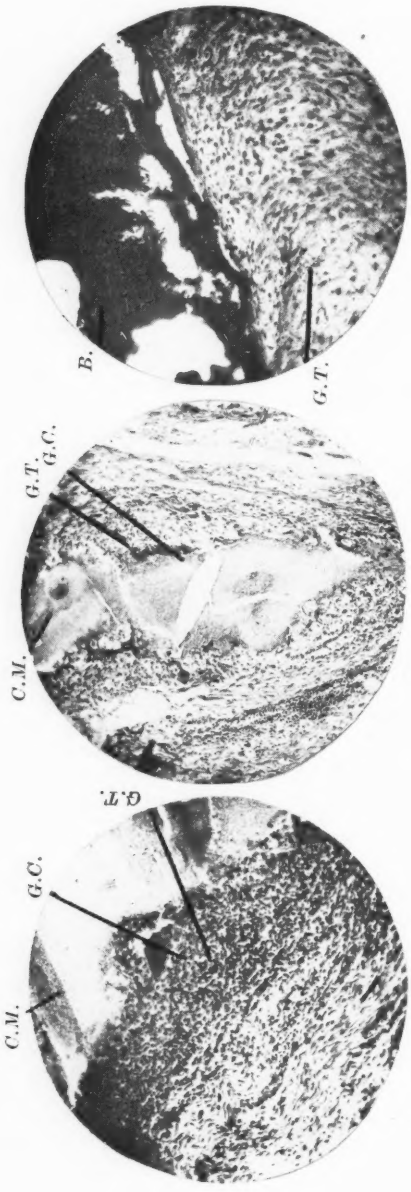



Fig. 31. Fig. 32. Fig. 33.

Fig. 31.—Implantation of calcified mass kept cool and sterile for 14 days, without infection, into the back muscles of a young rabbit. After 14 days we find amorphous calcified masses, *C.M.*, surrounded by granulation tissue, *G.T.*, of the surrounding tissue rich in cells, with giant cells, *G.C.*, *G.T.* Concentric fibers in the external strata of the granulation tissue.

Fig. 32.—Implantation of small calcified mass kept cool and sterile for 14 days with infection into the back muscles of a young rabbit. After 2 months, we find an amorphous calcified mass, *C.M.*, surrounded by granulation tissue, *G.T.*, surrounding tissue and erosion processes through giant cells, *G.C.* There is no change into osteoblasts and no bone-building processes.

Fig. 33.—Implantation of burned bone into the back muscles, with infection, of a young rabbit. After 1 month we find, burned bone, *B.*, with granulation tissue, *G.T.*, of surrounding tissue surrounding it, rich in cells, with fibrillary formation. There is no change into osteoblasts and no bone-building processes.

connective tissue fails because of the mass (involved). In these cases the connective tissue accomplishes only an encasing (of the bone) as a foreign body. The situation here is exactly the same as in the transplanting of living bones into the soft parts, when the osteoblasts of the latter have been destroyed by hæmorrhage or infection. If the surrounding granulation tissue is still young, it acts resorptively on the bones, as is well known. If, however, in such cases, the bed has once been transformed into a capsule, the remnants of bone remain

intact within this scar tissue. The situation is similar with the healing-in of dead transplants, especially in heteroplastic work and in the use of fresh bones from cadavers, in which cases the healing-in of the dead substances proceeds without a trace of the atrophic stage which otherwise sets in, but with firm encapsulation.[1]

In order to understand the reasons why, in our experiments, metaplastic bone-formation on the part of the ordinary mature connective tissue of the soft parts did not take place, and further, whence and how the heterotopic ossification of the soft parts comes into existence, more extended explanations are necessary. We know that, in the course of the atrophy and decay of tissues, they act upon the surrounding tissues and set in operation the whole series of resorptive and regenerative processes. At the same time they maintain the hyperæmia, caused by trauma or infection, which is the primary condition of all reparative and regenerative processes. Regeneration is thus immediately dependent upon the products of tissue decomposition. These products of tissue decomposition exercise in the tissue two kinds of activities: specific and non-specific. When they come in contact with living cells of their own kind, they stimulate them to the creation of cells specific for that tissue and cell products, or furnish them indirectly, through hyperæmia, with an increased supply of nutrient materials. On the other hand, the decomposition products at the same time stimulate the living tissue of different cellular composition also to the creation of cells and cell products of its own variety. Both processes take place side by side. Healing of defects of whatever kind depends upon the question whether, at the place where the tissues have been injured, tissues of the same structure are present in sufficient quantity, whether these possess sufficient vitality, whether their vitality and capacity for regeneration has not previously suffered through obstruction of the channels of supply, or whether, on the other side, the tissue of like cell structure has been injured or destroyed by the effects of trauma or infection, or through obstruction of the channels of supply.

In one instance regeneration takes place out of tissue and tissue products of like cell structure; in the other, only a defective substitute, produced by tissue of different cell structure results, in which case the non-specialized connective tissue, abundantly present in the body, provides for the substitute and leads to the formation of a cicatri.[2]

Now these products of tissue decomposition are of especial importance for our investigation. In dealing with the question of metaplasia, chemotrophic and other irritating influences are still considered, which are supposed to come from the living bone in process of decay and act upon the tissue of the host, stimulating it to metaplasia and bone formation. Irritating influences are present, their media are either trauma or infection, but chiefly the decomposition products of decaying tissue. In the second and third series of experiments, in order to test their capacities, we transplanted the decomposition

[1]Lexer. Die freien Transplantationen. vol. ii, Knochentransplantation. Stuttgart: Enke, 1924.

[2]Compare Knochenregeneration oder knoecherne Heiling von Frakturen on one side; Pseudoarthrosen, on the other side, Lexer Arch. f. klin. Chir., vol. cxix, and Rohde, Arch. f. klin. Chir., vol. cxxiii, and part I of this article.

products which had separated out in the test tube, along with the bones. For the rest, in all the experiment series the decomposition products liberated in connection with the healing-in of the living body through the breaking down of the transplants take part in the process. The question now arises, upon what tissues these products of tissue decomposition act. Since Basckkerziew and Petrow deal with bone fragments transplanted living, the decomposition products affect in the first place the living osteoblasts of the bone which are transplanted living along with it: they stimulate them to regeneration; thus bone formation arises from these osteoblasts. On these grounds, as we have already mentioned, bone fragments transplanted living in soft parts cannot be cited in proof of the capacity for metaplasia of the connective tissue in bones. Moreover, we know, in the pathology of pathological decomposition processes of the most varied sorts, from living bones there is no ossification in the neighboring soft tissues. Unfortunately, bones experimentally transplanted alive into the living bodies of animals cannot be brought, as is desirable, to a gradual mortification and decomposition in such a way as to eliminate the bone forming capacities of its osteoblasts. However, one may mention those cases from human pathology, also suppurative bone transplantations in soft parts in animals, in which, in living bodies, around bone fragments slowly dying on account of infection, no sort of bone formation takes place in the surrounding soft tissues, but in which the dead bones are occasionally removed from a granulation cavity by later operations or are spontaneously ejected. We have made histological examinations of such bones and the flesh in which they were embedded, in a whole group of such cases, and have never found bone formations.

If the capacity of osteoblasts of the transplants for life and regeneration are eliminated through appropriate experimental arrangements, the decomposition products of the bone tissues may act only on the cells of the host. In our experiments, a bed was chosen which had no osteoblasts; thus regenerative processes caused by the latter did not take place. Only such processes were possible as led to the formation of tissues which were present and vital on the spot. Otherwise, the connective-tissue cells would have to be led back by the decomposition products and the tissue reaction sustained by them, to an indifferent stage which would enable them to form also other derivatives of the connective-tissue series, such as *Knochen vorstufen and bones.* We take the standpoint of the anatomists, that Dollo's law of the non-reversibility of a development process once under way holds good for histology also. Cells which, in the course of their growth, have developed out of mesenchyme cells into ordinary connective-tissue cells, and have thus been so transformed that, according to the anatomist, Maurer, they may be designated only as remnants of the original primitive cells, cannot again become differentiated so that they may revert to indifferent mesenchyme cells and from these develop into osteoblasts. In this process there disappears also the possibility of bone formation out of ordinary connective-tissue cells. The implants and their constituent parts and decomposition products influence only the locally stationed cells to reactive processes under the influence of hyperæmia, which in all experiments appears clearly in the first week. Thus there arises out of the connective tissue

a granulation tissue with connective-tissue cells which at first are round and vesicular, later become spindle-shaped, and which consistently with their origin, can develop only into a mass of connective tissue, but never into Knochen vorstufen or bones. Our experiments show that very clearly.

From clinical observations as well as from our experiments, we come to very definite conclusions, namely, that metaplastic bone formation does not take place from the ordinary connective tissue, and that bone formation in every instance is to be attributed to specific bone-forming cells (osteoblasts). The osteoblasts are formed either in the general development process through differentiation from the indifferent mesenchyme cells; or they are formed after the conclusion of the tissue and organ development from osteoblasts which are present (periosteum and endosteum) through regeneration processes; or they arise in a completely developed organism through differentiation or mesenchyme cells which have remained undifferentiated. From a study of anatomy and pathology (tumors) it is evident that even in a completely developed organism, youthful embryonic cells with their manifold possibilities of development and differentiation, may remain present throughout a whole lifetime, and at an appropriate time may unfold their possibilities of development. Of course, this holds good also for the layer of embryonic mesenchymal tissue. In the course of the tissue and organ development the mesenchyme develops into connective tissue, fascia, tendons, fat tissue, muscles, cartilage, bone-forming tissue, or bone. There remain here and there undifferentiated cell groups, which do not participate in the further development of the organs. These unused mesenchyme-cells (Stamm cells after Stohr von Mollendorff) retain in themselves all their development potentialities. In later life if any kind of traumatic, infective, or toxic irritation or metabolic disturbance affects cells of this kind, they are brought out of their latent stage and are able, within the limits of their peculiar development possibilities, to differentiate themselves. Along with other derivatives of the mesenchyme series there may also occasionally arise out of such cells tissues of the bone series.

Heterotopic bone formation finds in this its explanation. As for parosteal ossifications, Lexer and others have always emphasized that not the ordinary perfect connective-tissue formation but only very special, adapted connective-tissue formation permits ossification-processes to arise. From our study we can understand this.

It is easily understood that in the immediate neighborhood of the bone structure unused mesenchyme cells remain and that under the influence of some irritation or metabolic disturbance, these occasionally unfold their slumbering osteoblastic possibilities. Thus myositis ossificans circumscripta becomes comprehensible, though it is to be observed here also, that, in a great number of such cases, the cause is the tearing of the periosteum. Myositis ossificans progressiva is likewise to be explained by bone formation from unused mesenchyme cells, which under the influence of metabolic processes, develop their bone-forming capacities; the histological proof of the transformation of such cells of the intermuscular connective tissue into cells with the properties of osteoblasts, Lexer was able to produce years ago in his studies on myositis

ossificans progressiva.[1] Ossification of the achilles tendon of many kinds of birds near the heel-bone, abdominal bone formation in the castration scars in animals, and abdominal bone formations in man; likewise penis bones in man are explained, and are at the same time atavistic reversions.

With reference to abdominal bone formation in laparotomy scars we will cite two cases of our own. In the first case, the patient was a 58-year-old man with greatly enlarged abdominal veins, in whom a carcinoma of the pylorus was resected. In the course of the after-treatment, a thrombosis of the greatly enlarged subcutaneous abdominal veins set in. Ten months after the operation, there was observed in the patient, who had made a magnificent recovery, within an insensitive scar, about four finger-breadths below the xyphoid process, a hardening about 6 centimeters long and 3 centimeters broad, which a histological examination revealed as a formation composed of bone, cartilage, and connective tissue. It lay within the connective tissue of the abdominal fascia.

The second case was a 33-year-old man, who had had a gastroenterostomy for duodenal stenosis. After 10 days, in which no fever developed, the stitches were removed; healing took place by first intention. The patient was up and about. The next day after

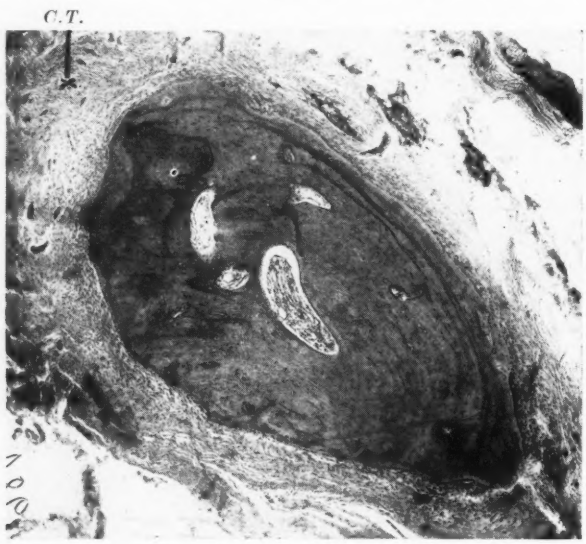



Fig. 34.—Formation of bone in the abdomen of a man, 33 years old, 22 days after a gastroenterostomy for duodenal stenosis, inside of thick fibrous connective tissue, *C.T.*, of the abdominal fascia.

operation or after stitches were removed a little hæmatoma drained. Twenty-two days after the operation there was removed from the wound, which healed *per secundum*, a hard formation, 2 centimeters long, and as thick as a match, which had developed within the fascia midway between the umbilicus and the xyphoid process. Upon histological examination (Fig. 34) there was found a well-defined bone formation with several lamellar systems and detached marrow spaces. Besides completely formed bone there was cartilage, osteoid, and young embryonic tissue, which proceeded from the firm-connective tissue of the surrounding substance.

To both these cases of true bone formation in the abdomen in laparotomy scars we can add a third important observation. It concerns a 42-year-old woman in whom 22 months previously a chronic appendix had been removed through a pararectal incision. Primary union of the wound. Twenty-two months after the operation the patient came to the clinic on account of a painless hard mass in the operation scar which had developed slowly in the course of 3 months. At operation there was a stone hard mass in fibrous scar tissue of the abdominal muscles which was removed. Histological study (Fig. 35) shows inside the scar tissue, consisting of spread out connective-tissue bundles which have

[1]Arch. klin. Chir., 1895, l, 1.

become hyalinized, some normal muscle fibers and a larger number of calcified muscle strands. In the vicinity of this calcification there is an increase in the number of cells, but no cells similar to osteoblasts and no bone building processes are present. In this case in spite of abundant calcification in the destroyed musculature there was no bone formation after 22 months.

It is known that in abdominal wounds and scars very often calcified deposits are found but no bone formation. The presence of calcium salts alone then cannot be the cause of heterotopic bone formation, otherwise in the numberless laparotomies it would occur more often. In all tissue destroyed and in hæmorrhage there is calcium deposition. If one considers how often these processes take place in different parts of the body, which have a predilection for heterotopic bone formation (elbow, upper arm, thigh, abdominal wall), and how extraordinary seldom in these same areas bone formation in soft parts has been observed, we are astonished at the importance, and sometimes very great

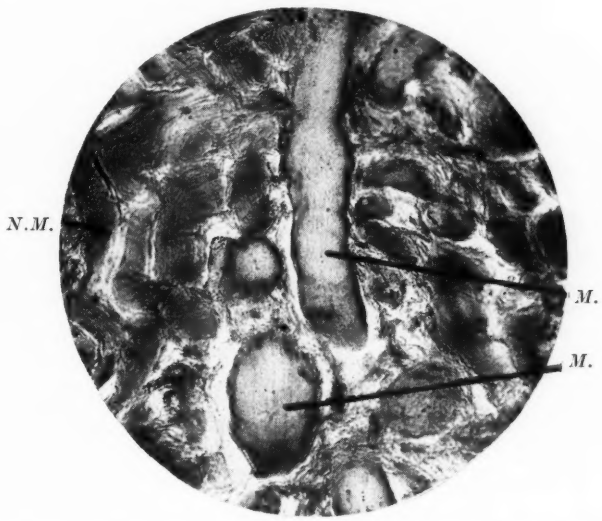



Fig. 35.—Calcified muscle fibers, *M.*, in abdominal wall scar, woman 42 years old, 22 months after appendectomy. No change into osteoblasts and no bone-building processes are present. *N.M.*, Normal muscle fibers.

importance, assigned to the deposition of calcium in the tissue in the pathogenesis of bone formation in soft tissue. The calcium salts are of importance only when they come in contact with osteoblasts or remaining mesenchymal cells. If this contact is not attained, even if the calcium salts are abundantly present, no osteogenesis takes place in the soft tissue. The rôle of calcium salts in heterotopic bone formation in the soft parts, and especially in bone pathology, is of secondary importance. *Fundamental prerequisites for bone formation* are *living osteoblasts or unused remaining mesenchyme* cells which can develop into osteoblasts. These bone-building cells, without any spontaneously developed deposit of calcium salts and without artificially brought bone-building substances can take the organic and inorganic substances from the living organisms which they need for building of bone. A measure of support to these processes through local or general diminution of organic or inorganic bone-building substances may be allowed in certain cases of disturbance of the local or general calcium metabolism. A fact to be learned in advance is that

the use of such things in the organism is not connected with a damaged osteoblastic tissue, which fact Cotton pointed out in the discussion of his magnesium injections.

As a result of clinical experience and our experiments we have come to the conclusion that after excluding tissues and organs, bone building power is found only in specific bone-building tissues (osteoblasts of the periosteum and marrow endosteum). Metaplastic bone building from the usual connective tissue of the musculature, the muscle septa, the tendons, the fascia, and the subcutaneous tissue does not take place. Heterotopic bone formation in soft tissue is from the unused remaining mesenchyme cells, which, through traumatism, infection, toxic stimuli, or disturbance of metabolism, may abandon their indifferent stage at any time and commence to build bone.

This work was made possible partly through the aid of the Rockefeller Foundation to which the author wishes to express his heartfelt thanks.

# SOME POINTS ON DIAGNOSIS OF MALOCCLUSION*

By George W. Grieve, D.D.S., Toronto

THIS clinic is intended to demonstrate, in conjunction with photographs, a simple, yet fairly accurate method of ascertaining, in a case of malocclusion, the relation which the maxillary teeth bear to the cranium, and, with this dental arch and the median line of the face and palate as a base, the position of the mandible and the relation of all the teeth to the line of occlusion.

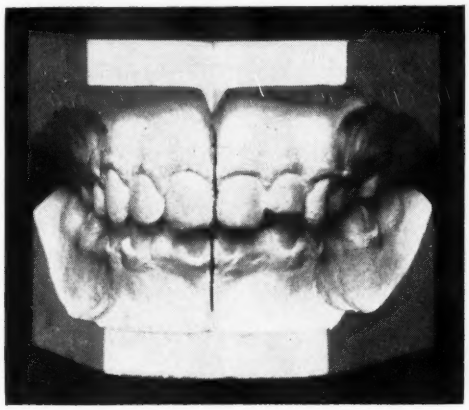


Fig. 1.

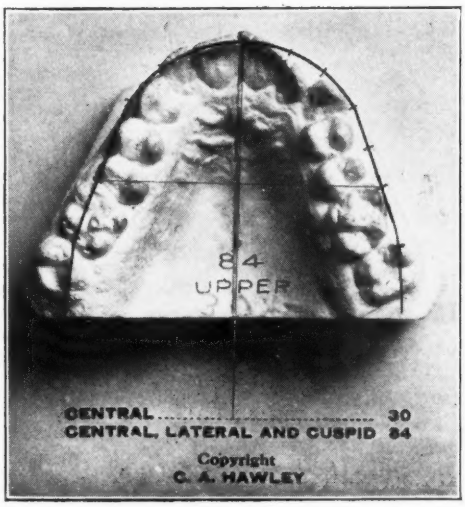



Fig. 2.

Fig. 3.

The light line in the soft tissues overlying the median suture in the palate can be taken as a fairly accurate guide as to the median line of the cranium. This line, in conjunction with the median line of the face, which latter may be obtained by a careful study of its various features as a whole, will give the

*Clinic given before the Twenty-fifth Annual Meeting of the American Society of Orthodontists, held at Atlanta, Ga., April 14-17, 1925.

orthodontist some base from which to measure any deviations of the teeth from the normal line of occlusion. This light line in the palate cannot be depended upon in its anterior part, but is fairly reliable about opposite the first permanent molars.

Before placing the plaster for an impression of the maxillary dental arch, a line about one-eighth of an inch long is made with an indelible pencil upon the light line on the palate opposite the first molars. The pencil mark will be transferred to the impression, at which point a short V-shaped cut is made. This comes out upon the cast as a ridge, and indicates the median line of the palate at that point.

Before the casts are trimmed, an appointment is arranged with the patient to obtain the median line of the face, the relation of the mandibular to the maxillary teeth and of the mandible to the cranium. The median line of the face is marked first upon the maxillary cast. The occlusal relations are marked

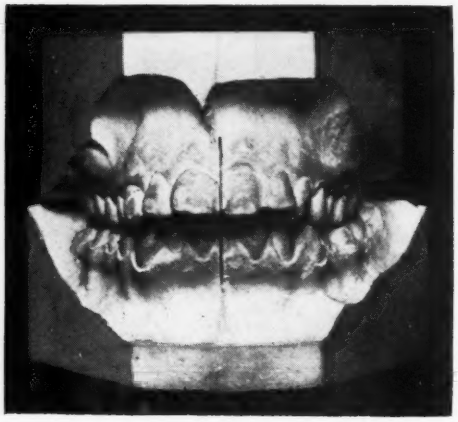


Fig. 4.

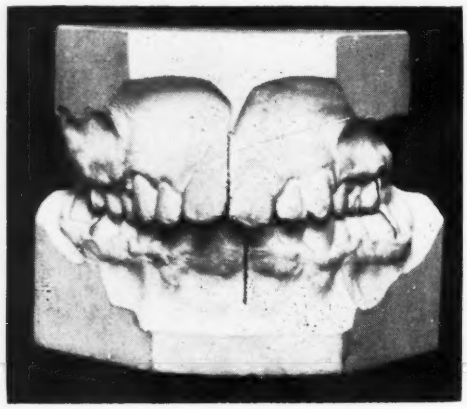


Fig. 5.

upon the lingual surface of both casts. A study of the facial lines by the operator, in his endeavor to locate the median line, has demonstrated the balance or otherwise of the mandible to the rest of the face. If there is no shift of the mandible, the median line of the face is marked also upon the mandibular cast, with the teeth in occlusion. Fig. 1 shows a case in which there is practically no shift of the mandible or the teeth in either dental arch. If there is any shift of the mandible, the patient is instructed to swing the latter over until it rests true with the balance of the face, and the point where the median line falls upon the mandibular dental arch is noted, and marked upon the cast.

After these landmarks are placed, the casts are ready for trimming of the base and capitol. When this has been completed the line upon the anterior surface of the maxillary cast, indicating the median line of the face, must be carried over upon the palatal surface of the cast and connected up with the ridge indicating the location of the median suture. This extended line is shown upon the cast in Fig. 2, with a Hawley Chart superimposed. I have suggested to Dr. Hawley the addition of the median and transverse lines to his charts, as shown in this illustration.

With the median line of the Hawley Chart placed over the median line marked upon the palatal surface of the maxillary cast, the lack of harmony of the teeth in this dental arch is at once apparent.

In completing the trimming of the casts, the posterior surface of the maxillary cast is trimmed at right angles to the median line, the two sides are trimmed at equal angles to the posterior surface, the point of the cast in front is placed on the median line, regardless of whether there is any lateral drift of

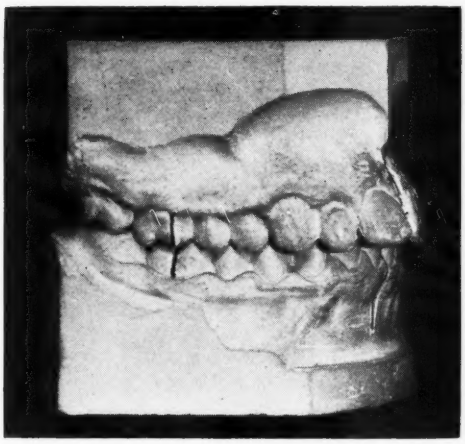


Fig. 6.

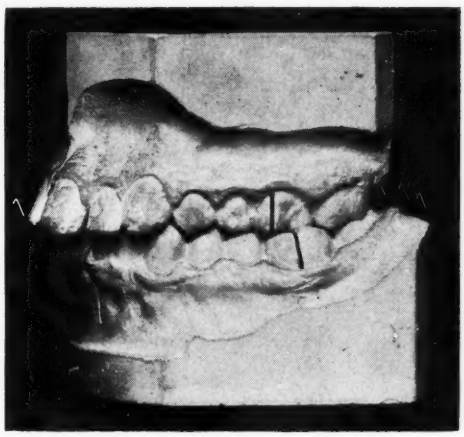


Fig. 7.

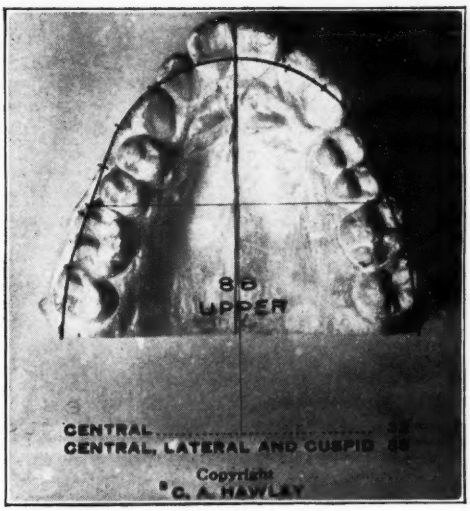



Fig. 8.

the teeth or not, and the anterior segments (from median line to approximate center of canines) are made equal in length and at equal angles from the sides. The mandibular cast is trimmed to conform to the maxillary cast, with the teeth in occlusion.

In Fig. 3, a chart superimposed over a maxillary cast similarly marked shows some forward drift of the teeth upon the right side. Fig. 4 shows that there is a slight tipping of the maxillary incisor to the right and a more definite bodily drift of the mandibular teeth in the same direction. A careful

study of the face in this case indicated that there was no shift of the mandible. These lines upon the anterior surface of the casts give a permanent record of the original positions, laterally, of the teeth. The frenum in this case was dragged to the right when obtaining the impression. Figs. 5, 6 and 7 show casts of a case which might, if the median line were not carefully noted, be diagnosed as a unilateral distoclusion. In this case there was a very marked shift of the mandible. Fig. 8 shows that if there was any forward drift of the maxillary teeth it was practically equal upon both sides. As a matter of fact, this was a neutroclusion case, with slight lack of forward growth of the mandible.

I have found the use of the method here briefly outlined of great aid in diagnosis, and the marking of the casts registers a permanent record to guide the operator during the treatment of the case. From the profile photograph of the patient one can best determine as to the horizontal growth of the mandible in relation to the rest of the face.

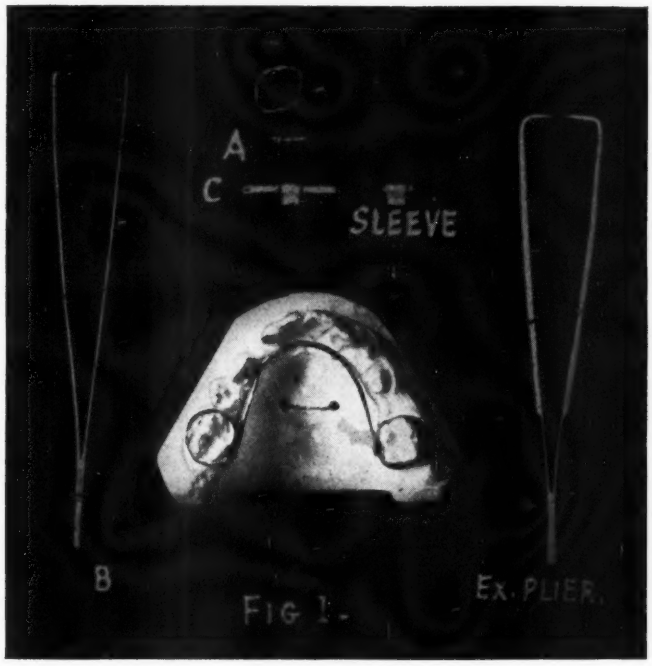
# CLINIC—A LINGUAL ARCH LOCK*

By J. Lewis Walker, D.D.S., Norfolk, Va.

I WOULD like to add one more lingual arch lock to the list, one which I have used with much satisfaction the past few years, and the construction of which is simple and easy.

The anchor bands are made in the usual way. An impression is taken with them in place, the bands removed, and a thin coating of wax run over the inner surface, replaced in impression and the model made. The bands are then removed and attachments correctly made, not disturbing the shape of band.

Fig. 1 shows the construction of the lock; *A* shows a 19-gauge round tube one-sixteenth of an inch long (or any desired length) to which the spur




is soldered. *B* shows a suitable plier to hold the tube for attachment to band which should be as far distal as possible; care should be taken to leave a clear space between the spur and band for the sleeve, which may be made of 30- or 32-gauge plate one-eighth of an inch long. *C* shows the shaping of the sleeve on 19-gauge wire doubled. Remove the sleeve from the wire, and insert a piece of wood suitable in size as anti-flux and solder. Before cementing the band it is very necessary to cut a shallow notch gingivally on the spur, similar to the one on the pin of the old pin and tube appliance, bending very slightly the end of the spur, which may be done at any future time with a suitable instrument should the sleeve slip forward. The sleeve, finished, is put in on the arch before bending the ends.

*Clinic read before the Twenty-fifth Annual Meeting of the American Society of Orthodontists, held at Atlanta, Ga., April 14-17, 1925.

# THE LOOP BAND AND THE CEMENT LOCK*

By Jos. E. Johnson, Louisville, Ky.

THE band in Fig. 1 is called a loop band. It is a seamless contoured band with a loop the size of a 16-gauge bar. The main feature of the band is the loop. When the band is forced over the tooth the loop spreads apart and allows the band to slip over the contour of the tooth.

Fig. 1.

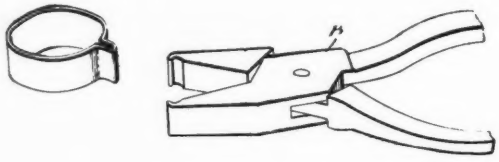


Fig. 2.

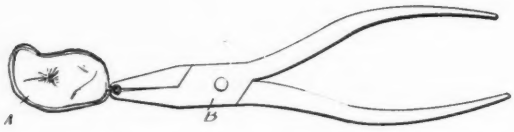



Fig. 3.

Fig. 4.

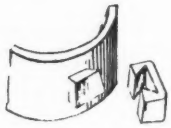


Fig. 5.

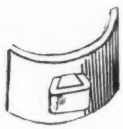
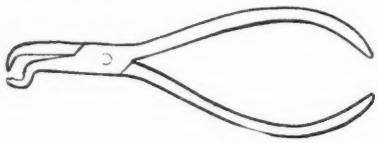


Fig. 6.



Then with pliers (Fig. 2), the beak of which have a 16-gauge groove that fits over the loop in the band, the band is drawn tightly around the tooth and is then removed and soldered.

*Clinic read before the Twenty-fifth Annual Meeting of the American Society of Orthodontists, held at Atlanta, Ga., April 14-17, 1925.

The loop band has the following advantages:

1. It eliminates the necessity of carrying a large assortment of bands in stock, three sizes being all that are needed.

2. It is easy to place the band on the tooth, for as the band is pressed down the loop opens and the band slips over the bell crown of the tooth.

3. There are no sharp edges to lacerate the cheek or gums.

4. The band is easily fitted to the tooth. All that is necessary is to draw the loop together with the plier.

5. It makes a very tight fitting band, because the groove in the pliers grips the shoulder of the loop of the band, which enables one to stretch the band around the tooth very tightly.

Figs. 4 and 5 illustrate a lingual lock which is known as a cement lock. It consists of a lock and a lock-lug. The lug is soldered to the band. It is tapered and dovetailed. The lock is milled to fit the lock-lug very accurately. The lock is cemented to the lug, which makes a very rigid lock. In fact it is the same as if the lingual bar were soldered to the band.

Fig. 6 shows the pliers that are used to remove the lock. They are universal pliers, that is, they work on maxillary or mandibular teeth, right or left.

The cement lock has the following advantages:

1. It is so short that it does not interfere with occlusion, nor does it impinge on the gum.

2. The lingual bar is soldered directly to the lock and does not have to be bent to lie along the gingival.

3. An extension can be soldered on the distal surface of the lock as easily as on the mesial.

4. The cementing of the lock makes it as rigid as a soldered bar and there is no danger of the lock coming loose.

5. The lock is easily slipped into place.

6. It is, also, easily removed with the pliers.

**Under Editorial Supervision of**

**M. N. Federspiel, D.D.S., M.D., F.A.C.S., Milwaukee.—Vilray P. Blair, M.D., F.A.C.S., St. Louis, Mo.—Theodor Blum, D.D.S., M.D., F.A.C.D., New York.—Leroy M. S. Miner, M.D., D.M.D., Boston.—Wm. L. Shearer, M.D., D.D.S., Omaha.—Fredrick F. Molt, D.D.S., Chicago.—Robert H. Ivy, M.D., D.D.S., Philadelphia.—Edward L. Miloslavich, M.D., Milwaukee**

# OBSERVATIONS ON THE PHARMACOLOGY OF LOCAL ANESTHETICS*

By John A. Higgins, Chicago, Ill.

IN TESTING local anesthetics for comparative toxicity on the various animals, as reported in a previous paper,[1] certain symptoms were observed that were deemed of sufficient importance to warrant further investigations.

Following a lethal or slightly sublethal subcutaneous injection of a local anesthetic in animals, there appeared marked cyanosis either preceding or during a convulsion, a gasping for breath, or other indications of marked respiratory trouble. Where fatal results were observed they appeared to be due primarily to respiratory failure. Some of the animals injected with a local anesthetic vomited either a bile or a bile and mucus mixture. This vomiting in many instances, perhaps caused by muscular exertion, seemed to initiate the convulsions that followed. In animals, recovery from synthetic local anesthetics was more rapid than recovery from cocaine. Food offered to animals recovering from a cocaine injection would often cause salivation and the animals would turn their heads away from the food.

A series of experiments were now carried out with the object of recording in a graphic manner some of these local anesthetic reactions. The animals used were etherized in the usual manner. The right femoral artery was ligated and connected to record the blood pressure while the respiration was recorded from a side outlet of the trachea cannula. After the preliminary arrangement of the animal and apparatus a lethal or slightly sublethal subcutaneous injection of the local anesthetic was made into the animal. The general ether anesthesia was now reduced so as not to interfere too greatly with the drug effects. The incisions were kept moist with a solution of the same local anesthetic as injected, thus minimizing pain while under the light general anesthesia. The drug effects

*From the Pharmacologic Department of the Abbott Laboratories, North Chicago, Ill.

in these experiments came on gradually and the graphic records obtained were spread over a considerable amount of drum paper. To avoid difficulties in the reproduction of the charts in their entirety certain sections only will be presented in order to bring out the most important points.

Five or six minutes after the subcutaneous injection of 3.02 c.c. of a 15 per cent cocaine solution into a dog weighing 9.06 kg. (approximately 50 mg. of cocaine per kg. bodyweight) there was a gradual rise of 28 mm. of mercury in the blood pressure. The amplitude of the respiratory markings, as recorded by the writing lever, was increased some 55 mm. Following this preliminary rise in blood pressure and increased respiration there was a gradual fall in blood pressure, together with a gradual depression in respiration. The heart and respiration soon became irregular and convulsions set in. While the

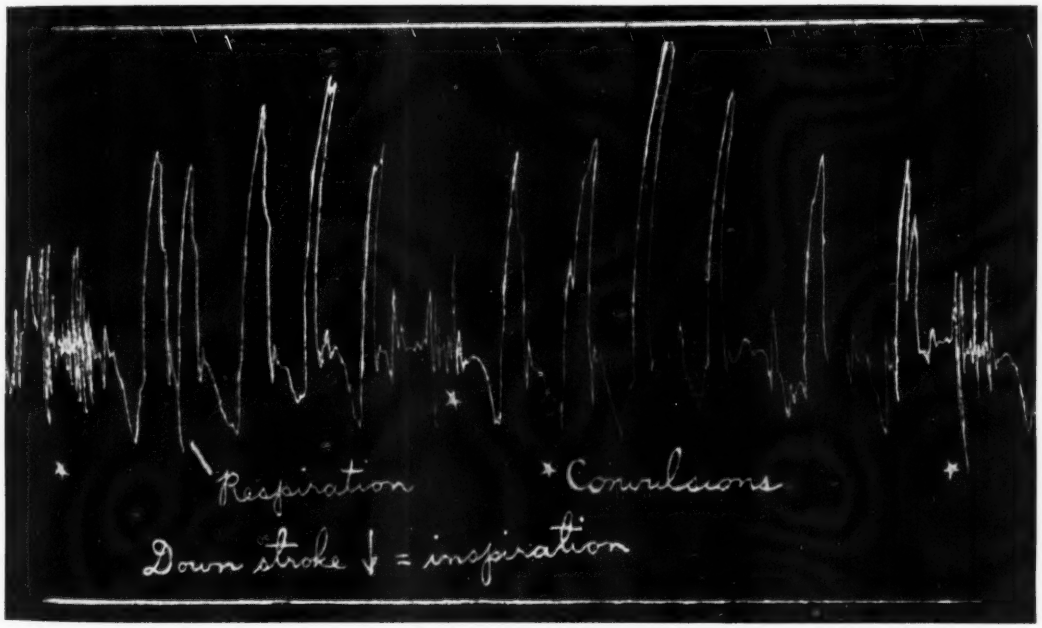



Fig. 1.—Showing the effect of cocaine on the respiration of a dog.

amplitude of the respiration would now seem to indicate a greater amount of air going in and out of the lungs, as compared to the normal record, yet this was not so in reality. The increased amplitude was the result of spasmodic convulsive movements, the animal seemingly trying to resist a respiratory failure. This point was brought out more clearly when the speed of the kymograph was increased (Fig. 1). Here it will be noted that the respiration becomes much depressed, the animal goes into a convulsion, which seems to aid temporarily in the inflation of the lungs. The animal, however, is unable to maintain this increased inflation and as a result the same series of reactions continues to repeat itself. A typical irregular cocaine heart action sets in, together with a gradual decrease in amplitude of the respiratory tracing. This general depression continues until just before death when the animal makes a last fruitless endeavor to reestablish the gradually failing respiration (Fig. 2). A small section of the blood pressure record was added to this tracing to

show the irregularity of heart action and also to bring out the point as to whether the heart or respiration stops first.

The experiments were repeated in other dogs in which different synthetic local anesthetics were substituted for cocaine. Dog No. 4, for example, was injected with a sublethal dose of butyn. Here the preliminary increase in respiration was noted without any rise in blood pressure. As the respiration becomes depressed and the blood pressure gradually falls the animal soon goes into convulsions. As in the case where cocaine is injected, the convulsions materially aid the inflation of the lungs, but the animal is unable to maintain this increased inflation and again the procedure of depressed respiration, con-

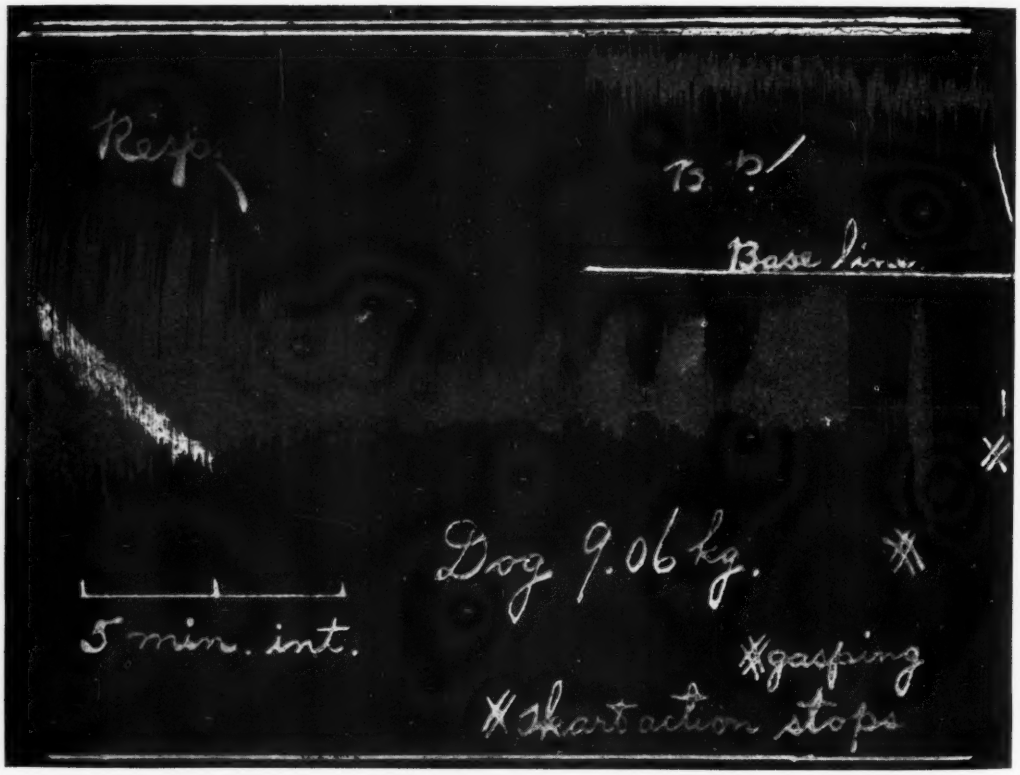



Fig. 2.—Showing a death record following an injection of cocaine hydrochloride.

vulsion, etc., repeats itself. Approximately fifty minutes from the time of the butyn injection in this animal a crisis, so to speak, had been reached. The general blood pressure had fallen 82 mm. and the convulsions occurred more frequently. From this point the amplitude of the respiratory record became gradually greater and more regular, thus indicating a better lung aeration. The convulsions became less frequent and soon stopped. Likewise the blood pressure increased towards normal.

In another dog, in which butyn was injected subcutaneously, we have a somewhat different picture. Here we have the customary respiratory changes (Fig. 3), but the blood pressure increases during each convulsion. This was a reverse action on the blood pressure as compared to results from the previous experiment. Fig. 4 is a continuation of Fig. 3 but taken with the speed

of the revolving kymograph increased. This record shows the usual decrease in the respiratory amplitude, convulsion, increase in the respiratory amplitude and the inability of the animal to maintain this increased lung inflation. This animal received a lethal dose of butyn, whereas the previous animal received a sublethal dose. The difference in the blood pressure curves of these two experiments is as yet undetermined. The rise in blood pressure in this last experiment might be attributed to a mechanical squeezing down of the peripheral vessels during the convulsions or it may be caused by asphyxia. In

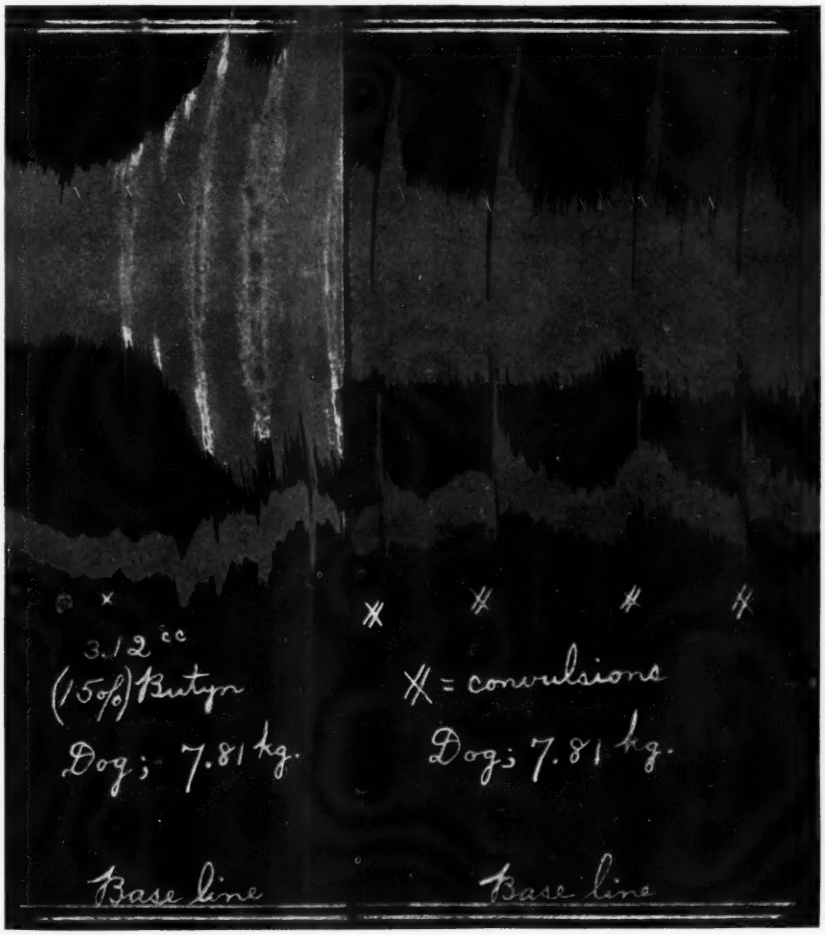



Fig. 3.—Showing the effect of butyn on the blood pressure and respiration of a dog.

this latter experiment the fall in blood pressure produced by the animal's endeavor to vomit is also recorded (Fig. 5).

Means of checking further toxic action of the local anesthetic were now applied. Artificial respiration alone was applied and the animal was benefited greatly. As the artificial respiration was discontinued convulsions again set in and the inhalation of ether was next considered and applied (Fig. 6). The inhalation of ether seemed to check the convulsions but did not benefit the blood pressure, which was falling towards the zero level. The inhalation of ether being discontinued helped the heart to some extent, while the respiration

soon stopped, and only following a series of convulsions did the respiration reappear for short intervals. Results obtained from intravenous injections of ethyl alcohol, eserine sulphate, pituitary extract, and epinephrin were now observed. In no case did these drugs materially help the respiration. The alcohol lowered the blood pressure approximately 28 mm. of mercury. The eserine sulphate, 2¼ mg., produced no appreciable effect. The pituitary extract ¾ c.c., produced a rise in blood pressure of 97 mm. of mercury, whereas 1 c.c. of (1 in 10,000) epinephrin produced a rise in blood pressure of only 17 mm. of mercury in the same animal. Fig. 7 gives a general idea of what would be

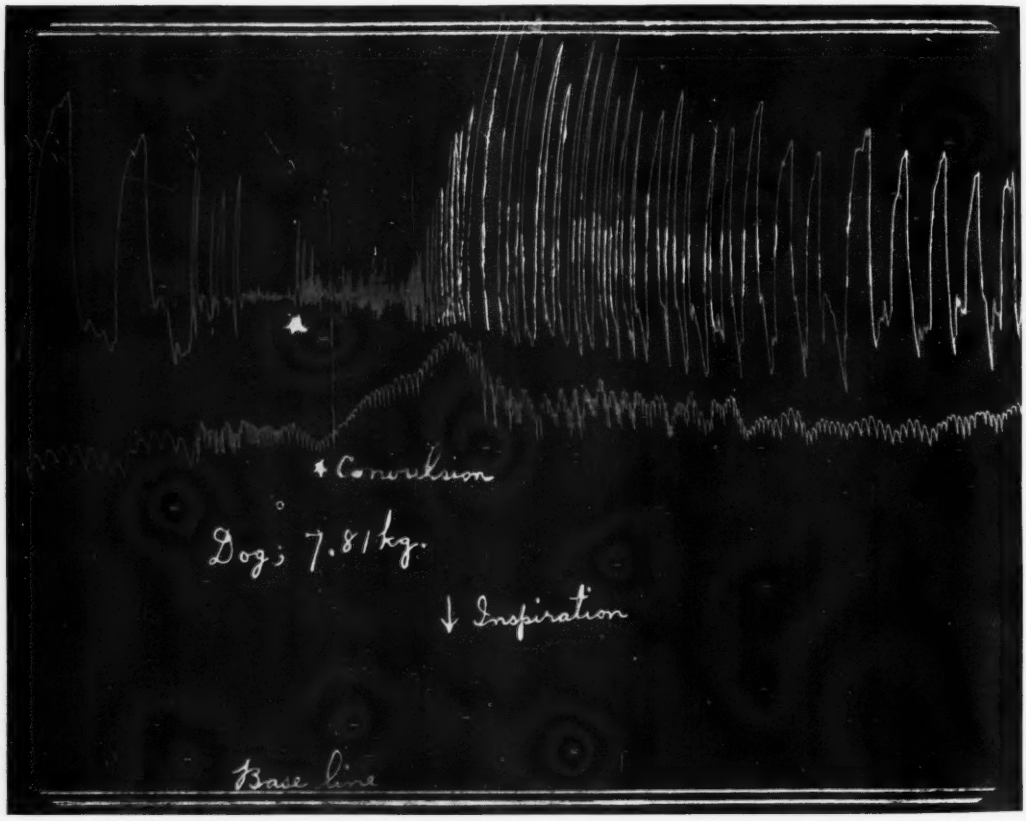



Fig. 4.—Showing the effects of a convulsion on the blood pressure and respiration of a dog.

expected from the epinephrin injected had not the local anesthetic been injected previously.

A factor which I now had in mind was to compare the drug effects produced by the local anesthetics with effects produced by other drugs known to produce convulsions and thereby find whether or not it is possible to draw general conclusions regarding convulsions. In this respect 2 c.c. of (1 per cent) brucine produced an action on the blood pressure and respiration similar to 2 c.c. (1 per cent) procaine. In another animal 5 c.c. (10 mg.) of strychnine produced some stimulation of the respiration, a subsequent stoppage of respiration, with tense thoracic and abdominal muscles, a symptom which might be interpreted as an endeavor on the part of the animal to ward off respira-

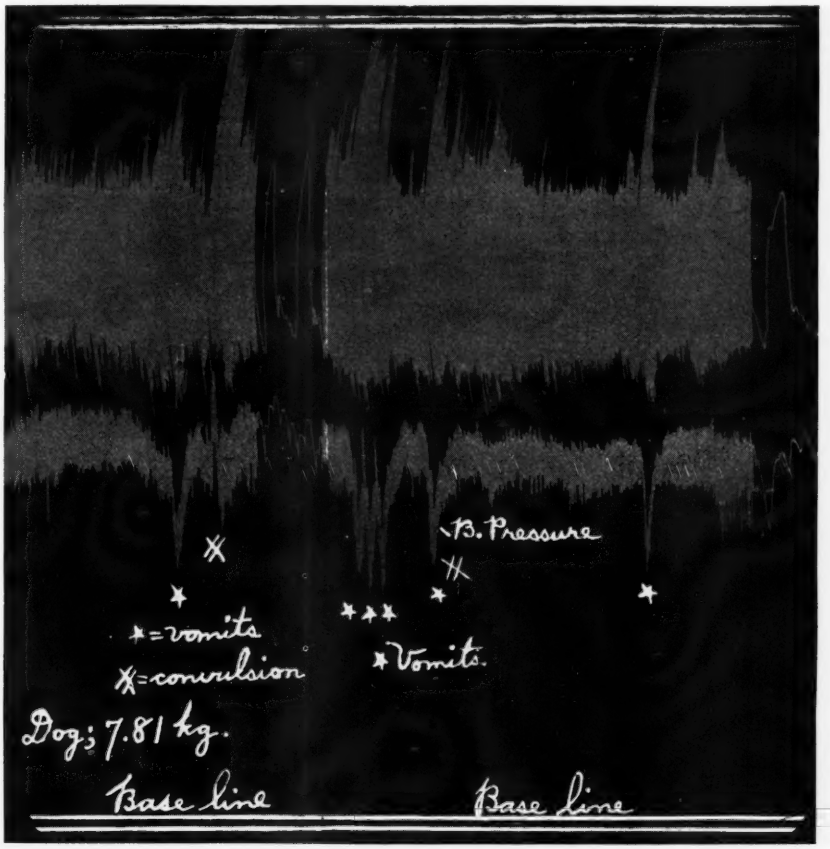



Fig. 5.—Showing the effect of a dog's endeavor to vomit; blood pressure and respiration.

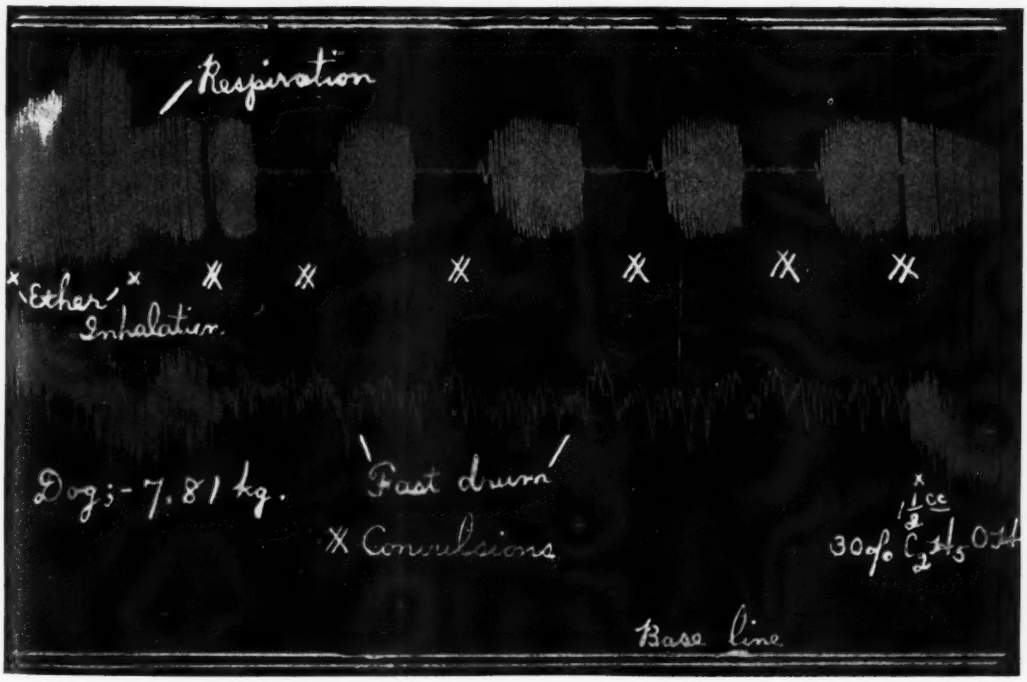



Fig. 6.—Showing the effect of butyn on the blood pressure and respiration of a dog.

tory paralysis. A convulsion then appeared which seemed to help to restore the respiration, but the animal was unable to maintain this reestablished respiration (Fig. 8).

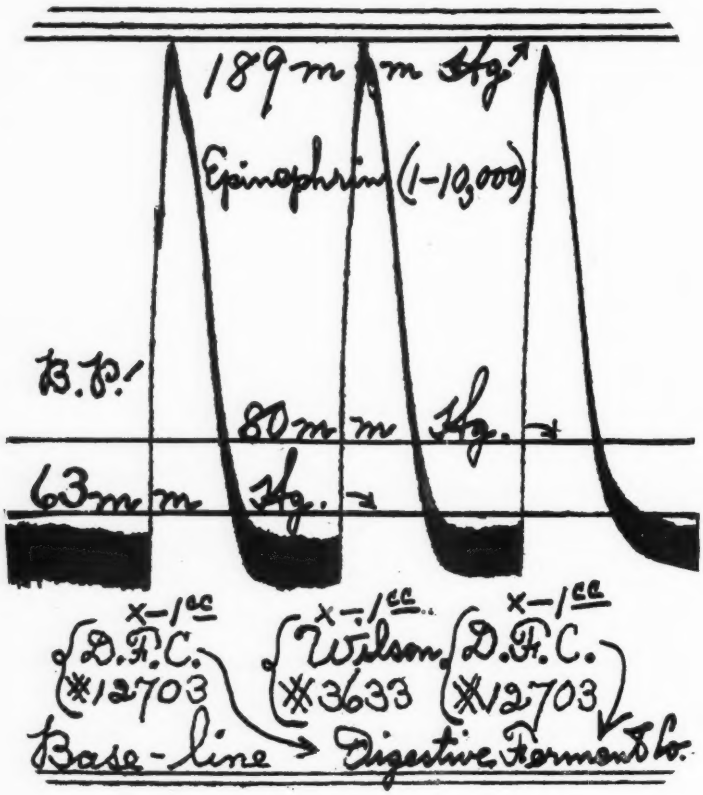



Fig. 7.—Showing blood pressure rise produced by epinephrin.

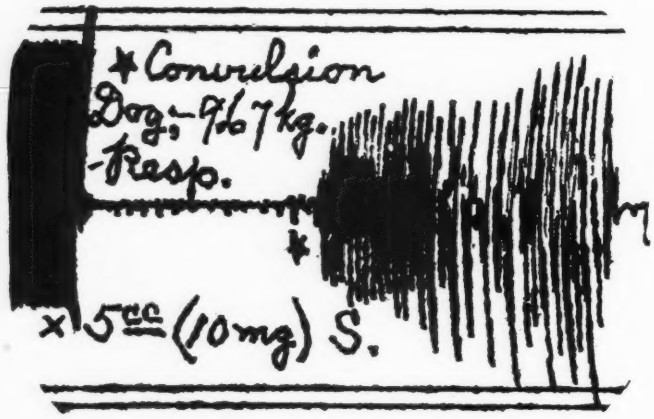



Fig. 8.—Strychnine action on the respiration.

## GENERAL DISCUSSION

As to the probable cause of convulsions, the results indicate that it is to be found principally in the effects on the respiration and the blood pressure. There is a gradual paralysis of the respiratory center; this respiratory paral-

ysis causes a decrease in the amount of oxygen reaching the brain centers and these in turn send out series of impulses (which we ordinarily look upon as convulsions) in order to counteract the respiratory paralysis. In support of this contention it is not uncommon to use ether inhalation to check convulsions resulting from strychnine or local anesthetics.[2] More recently hypnotics have been suggested and used in order to combat toxic symptoms and convulsions from local anesthetics. Unpublished experiments carried out at the Abbott Laboratories in 1923-24 showed that the hypnotic butylethylbarbituric acid administered previous to the subcutaneous injection of butyn in high sublethal doses partly or entirely eliminated convulsions in rabbits. As an explanation to this phenomena I would be inclined to believe that the brain centers become so depressed from ether inhalation or hypnotics that they are rendered incapable of generating impulses. It would not be surprising, in my estimation, if all drugs which depress the brain centers could be used as an aid in checking convulsions.

Further points of interest to this subject may be found in the literature. Cushny[3] states that, "artificial respiration has been shown to delay the onset of convulsions in animals, but it is still an open question whether this is due to the better aeration of the blood (Osterwald) or to the effects of the mechanical movements (Gies and Meltzer)." Experimental evidence as I see it would support the former view. Sollmann,[4] speaking of different forms of stimulation provoking strychnine convulsions, states that, "gradual stimulation is much less effective, so that a patient may support considerable but deliberate manipulation, as for instance artificial respiration when a slight but abrupt or unexpected touch would cause an attack." These statements from the literature on the subject agree with the experimental evidence I have presented.

In regard to the blood pressure, the local anesthetics have a tendency to paralyze the nerves whose function is to maintain a tonus in the blood vessel walls. The blood pressure therefore falls to a stage which may be considered similar to that of a spinal animal. It remains constant at this low level over a considerable period of time, injections of small quantities of local anesthetics causing no further lowering. This low blood pressure of course has a detrimental effect on the system, resulting in a failure to supply sufficient oxygen to the brain, accumulation of waste products in the brain tissue, or anemia[5] of the brain.

## CONCLUSIONS

Artificial respiration combined with the application of a direct muscular stimulant, in order to keep up the blood pressure, are very important measures for checking toxic symptoms produced by local anesthetics.

Convulsions seem to be due to a lack of oxygen for the proper function of the brain centers, this lack of oxygen being brought about by a paralysis of the respiratory center and a lowering of the blood pressure.

Drugs that depress the brain centers have a tendency to decrease or eliminate convulsions.

Ether, carbon dioxide, strychnine, etc., are considered as respiratory stimulants under normal conditions, but their uses under abnormal conditions must be considered cautiously.

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# *EDITORIALS*

## The First International Orthodontic Congress

AN EVENT of unusual importance to orthodontists and dentists interested in orthodontics will be the First International Orthodontic Congress that meets at the Commodore Hotel, New York, during the week of August 16 to 20.

For the first time in the history of this specialty workers from all parts of the world will meet together in conference to discuss ways and means for its further development. It is significant that the first congress devoted to this specialty is to be held in the land where it was first recognized as a distinct branch of dental science. It is further interesting to remember that the first man to put the treatment of malocclusion on a scientific basis and deliver it, figuratively speaking, from the womb of ignorance and uncertainty, is still living.

To Dr. Edward H. Angle, now living, practicing and teaching orthodontics in Pasadena, is given the credit, and justly so, for first showing to the world the basic principles upon which rest the diagnosis and treatment of mouth and jaw deformities. Much of the progress in orthodontics today is due to the high ideals of service and study that he created among the students who came from all parts of the world to sit at his feet, in St. Louis, where he taught and practiced. Many of these students are living and carrying on today. It will be a great experience for them to meet in conclave at the congress to be held in New York and to note the progress the science has made since they first stood by its cradle in the long ago. Possibly no specialists in medicine or dentistry are more fortunate. It is given to but few men in science to officiate at the birth of a specialty, to be privileged to aid its growth and development, and to live to see it attain the position that orthodontics has reached.

Well do we remember orthodontics in St. Louis twenty-five years ago. The mention of it would send dentists, physicians and laymen to the dictionary only to find that it was so new a science that the lexicographers had not given it a definition or a place among words.

Every boy or girl who receives orthodontic treatment, and by its touch develops a face symmetrical and pleasing to look upon, pours out a blessing upon this great science, its founder, and those who have done so much to develop it.

The First International Orthodontic Congress will mean much to this specialty. It provides a common meeting ground for those practicing it in all parts of the world. From England, France, Sweden, Belgium, Italy, Spain, Austria, Switzerland, and Holland will come those who have worked long and hard to solve the problems of malocclusion. Mingling with these master minds of the old world will be our own brilliant students in America, who for a quarter of a century have helped to hold high the torch that has lighted the way to more progress in orthodontics. This intermingling of minds with but a single thought will give an impetus to orthodontic development that no other movement could possibly give.

This congress will mark the dawn of a new day in orthodontics.

—*C. V. M.*

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## Personal Service Department

A MEDICAL or dental journal has but one excuse for existence—service to its readers. To live for any other reason is a travesty and an insult to the profession supporting it. It should be the aim of the editor and his associates, as well as of the publisher, to make their medical or dental journal so serviceable that it will live and grow for this reason alone.

Personally we feel that both medicine and dentistry can best be served by special journals—such publications are textbooks continually brought up-to-date. If properly conducted, they become a common meeting place, a forum, as it were, for the interchange of opinions by the best minds working in the field covered by such publications.

To serve its subscribers further, the INTERNATIONAL JOURNAL OF ORTHODONTIA, ORAL SURGERY AND RADIOGRAPHY is taking a forward step in its *Personal Service Department.* Beginning with the July issue this department, under the direction of Dr. H. C. Pollock, for orthodontia; Dr. C. O. Simpson, for radiography; and Dr. V. P. Blair, for oral surgery, will offer advice and consultation in the care and treatment of cases of any subscriber to the Journal who desires information and help with any case he may be treating.

The Journal for many years has been confronted with the problem of supplying information more of an elementary nature than is supplied by its usual run of scientific articles. It has been contended by many that the orthodontic department particularly is written more for the specialists and the men especially well trained and experienced in orthodontia than it is for the men who treat a case only now and then.

The Personal Service Department will discuss all questions impartially, and when any differences of opinion exist among authorities in this field, each will be discussed.

It is not our intention to treat cases of radiography, surgery, and orthodontics by "mail order," but we hope that an open forum in the Journal will prove of real merit and service.

A letter written by a subscriber in regard to a case of orthodontia with which he needs counsel, directed to Dr. Pollock, in care of the Journal, will be submitted to him. He will answer the question personally by mail within a few days after its receipt, and both question and answer will appear in the next issue of the Journal. The same procedure will be carried out by Drs. Simpson and Blair. By this method a twofold service will be rendered: The dentist seeking information will get it immediately and many subscribers having similar problems will receive advice and counsel through the publication of these letters.

Subscribers are invited to avail themselves of this service. It is the hope of both the Editorial Board of the Journal and its publishers that much good for humanity will be accomplished through this department.

—*C. V. M.*

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## The Report of the Committee on Dental Nomenclature

IN THIS issue of the JOURNAL is published a report of the Committee on Dental Nomenclature, as presented to the House of Delegates of the American Dental Association on September 21, 1925. We are publishing the report of the Committee in full because the report has a preliminary introduction which is interesting to the orthodontic profession.

In the introduction to the report the Committee calls attention to certain dental words which the profession has been using in a careless, confusing manner. The use of the words, *anterior, posterior, mesial,* and *distal,* by the orthodontic profession has been confusing. A few years ago the Committee on Nomenclature of the American Society of Orthodontists recommended that the word *anterior-posterior* be used in describing the relation of

the mandibular arch to the maxillary arch in preference to the terms *mesioclusion* and *posterioclusion*. This recommendation is made because the terms *mesial* and *distal* have been used to apply to certain tooth surfaces. It is obvious that these words are incorrectly used in describing tooth surfaces when we consider their meaning in anatomic descriptions. As has been shown by Hopewell Smith, the so-called *distal* surfaces are not distal in an anatomic relation to the body; instead the mesial surfaces of teeth should be called the distal. These terms, however, are deeply imbedded in the minds of the members of the dental profession. It will be difficult to bring more correct terms into general use. The terms *anterior* and *posterior* are much more descriptive of the so-called *mesial* and *distal* occlusion, and we are glad to note that the Committee on Nomenclature of the American Dental Association recommends those terms.

We are somewhat surprised, however, to find that this Committee is using *inferior* and *superior* to describe the teeth located in the mandibular or maxillary arch. The terms *maxillary* and *mandibular* are anatomic terms that cannot be misunderstood; they are so much better than *inferior* and *superior* that we are at a loss to understand how the Committee can sanction the latter. We are glad to note that the term *deciduous* is recommended as preferable to *temporary*.

The Committee has made no further attempt to define occlusion, malocclusion, or normal occlusion. The Committee has, however, recommended the word *aclusion* as a term to express the opposite of *occlusion*. We must confess that we do not understand what the Committee means by the expression *aclusion*. We understand occlusion to be the relation of the mandibular teeth to the maxillary teeth, as related to the face and cranium. We are led to assume that the Committee believes occlusion to be a mutual contact of the mandibular teeth with the maxillary teeth, which definition does not describe occlusion correctly. We have often called attention to the fact that many teeth have definite functional positions one to the other, and definite relation to the face and cranium, but that they do not come in contact with each other. Many animals would have a decided malocclusion if mandibular teeth were in contact with the maxillary teeth. It may be possible that the Committee suggests the word *aclusion* to describe certain conditions which have in the past been known as *open-bite*. The term *open-bite*, however, requires more careful attention than it has had in the past, and it is our belief that the term *aclusion* will fall just as far short of expressing the real deformity as the much used term *open-bite*.

We hope the dental profession will study the terms suggested, as they are worthy of study.

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## Group Practice in Dentistry

GROUP practice of medicine originated in the Mayo Clinic at Rochester, Minn. Previous to its foundation physicians worked alone or with a single partner. The association of a group of physicians in one hospital and the correlation of the efforts of each with those of the others, can be credited

to that master surgeon, Dr. Wm. J. Mayo. No one familiar with medical practice at this time can question the soundness of such a practice from both a scientific and an economic standpoint.

Since disease is so complex that one mind cannot encompass it, a patient suffering from a disease of any kind should be given the benefit of the knowledge and experience of many men. To accomplish this, the patient is usually referred to a continually lengthening line of specialists; this practice is both unscientific and expensive.

Grouping specialists, cutting down the expense to the patient and rendering him better service is the objective that can be attained in a well-conducted medical and surgical clinic.

There are plenty of critics of this method of practice, but to expect progress of any kind to come without criticism is to court sure and certain disappointment. Personally we feel that it is the ideal way to practice medicine, and we say this after twenty-five years of observation of physicians and medical practice. Contrary to general opinion, no one mind is made subservient to another in a well-conducted clinic or medical group, but an atmosphere is created that is conducive to better and more skillful work and better service to the patient.

Economically sickness is expensive. Not only is the patient himself put to a serious loss, but all those with whom he comes into contact in a business way lose. The employer having his office force disorganized when sickness takes away one or more of his workers bears his burden as well as the worker himself. For purely economic reasons then, if for nothing else, the group practice with its concentration of medical talent and its low overhead because of this concentration, commends itself to society.

Group practice can be and is being made just as attractive in *dentistry* as it is in medicine.

Recently we were privileged to spend a day at the Federspiel Dental Clinic in Milwaukee. This dental group was organized seven years ago by Dr. M. N. Federspiel, and it is now incorporated under the Wisconsin State Law as the *Dental Polyclinic*. It occupies its own commodious quarters. There are ten well-trained dentists and surgeons in this group besides laboratory technicians and roentgenologists. Dr. Federspiel is an F.A.C.S., as well as dentist and orthodontist.

It will be an inspiration to any dentist to spend a day in this clinic. Here he will see treatment for diseases and deformities of the face, mouth, and jaws, covering an almost limitless variety—cleft palate, harelip, orthodontic irregularities, prosthetic work, operative dentistry, and face and jaw surgery of all kinds. A well-equipped Department of Pathology enables the clinic surgeons to check their findings carefully. The ease and skill with which patients are handled in this clinic is astounding.

Group practice presents wonderful possibilities in dentistry—one can see these possibilities carried out and realized upon at the Federspiel Dental Polyclinic.

—*C. V. M.*

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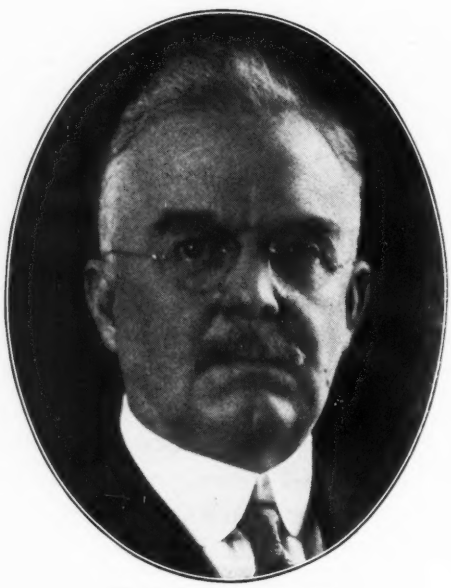

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Treasurer-General
First International Orthodontic Congress

# ORTHODONTIC NEWS AND NOTES

## First International Orthodontic Congress

PRELIMINARY PROGRAM

The First International Orthodontic Congress will be held at the Hotel Commodore, New York City, August 16 to 20, 1926.

1. *Badcock, J. H.*—London, England
   The Place of Extraction in Orthodontic Treatment
2. *Chapman, Harold*—London, England
   Orthodontics: Further Investigations in Etiology
3. *Chivaro, Angelo*—Rome, Italy
   Correlation Between Orthodontology, Dental Prophylaxis and Hygiene
4. *Deriveux, R. C.*—Nashville, Tennessee
   Orthodontia in Its Relation to Growth and Repair
5. *D'Alise, Corrado*—Naples, Italy
   Orthodontia and Dentistry in the Medicine of the Twentieth Century
6. *Detlefsen, J. A.*—Philadelphia, Pa.
   Developmental Limitations Imposed by Hereditary Factors
7. *Friel, Sheldon*—Dublin, Ireland
   Occlusion—Observations on Its Development from Infancy to Old Age
8. *Howe, Percy*—Boston, Massachusetts
   Influence of Feeding on Malocclusion
9. *Hellman, Milo*—New York, New York
   Changes in the Human Face Brought About by Development
10. *Izard, G.*—Paris, France
    *A.* Use of the Gonio-Mandibular Angle in Orthodontia: Its Measurement on the Living Man: Its Practical Importance and Result
    *B.* New Predetermination of Normal Dental Arches Grounded by Constructing an Individual Curve, According to Some Facial Diameters
11. *Johnson, A. LeRoy, Appleton, J. L., and Rittershofer, L. S.*—Philadelphia, Pa.
    Tissue Changes Incident to Tooth Movement.
12. *Kadnor, Albert*—Hamburg, Germany
    The Necessity of an Individual Ther apy Instead of Schematizing Methods
13. *Ketcham, A. H.*—Denver, Colorado
    A Study of Pathologic Root Absorption
14. *Kantorowicz, Prof.*—Bonn, Germany
    The Selfcorrection of Orthodontic Anomalies
15. *Lockett, A. C.*—London, England
    Finality of Treated Cases with Special Reference to European Conditions
16. *Lundstrom, Axel*—Stockholm, Sweden
    Further Studies in the Apical Index
17. *Mershon, John B.*—Philadelphia, Pa.
    The Lingual Arch
18. *Matthews, Cale*—Birmingham, England
    The Complete Temporary Dentition at the Eruption of the First Permanent Molars. Its Importance in Diagnosis and Classification
19. *McCoy, James David*—Los Angeles, Calif.
    Essential Technic in the Use of the Open Tube Appliance
20. *Pullen, H. A.*—Buffalo, N. Y.
    (Subject to be announced)
21. *Rubbrecht, Oswald*—Ghent, Belgium
    Title not yet received
22. *Simon, Paul*—Berlin, Germany
    Ueber die Notwendigkeit einer Gnathostatischen Diagnostik in der Praktischen Orthodontic
23. *Schwarz, Rudolf*—Basel, Switzerland
    Cephalometric Methods and Orthodontia
24. *Villain, George*—Paris, France
    The Importance of Occlusion and Articulation in Dental Orthopedia
25. *Young, J. Lowe*—New York, New York
    The Evolution, Construction and Manipulation of the Pin and Tube Appliance

*Educational Clinics* will be given in class form to cover the following subjects:

Plaster, impressions, models, etc.,
Band Technic
Lingual appliance construction
Labial appliance construction
Angle ribbon arch technic
Radiography
Photography
Engineering.

*Case Reports:* Over thirty, so arranged as to be on permanent display.

*Table Clinics:* *Fifty,* so arranged and tabulated that you can see practically any and all of the recent advances and developments in the mechanics of orthodontia.

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**Seventh International Dental Congress**

The hours of the Seventh International Dental Congress in Philadelphia next August 23 to 27, not occupied by deliberations and official transactions, will find the delegates almost overwhelmed with a program of entertainment and diversion. This program, which is rapidly nearing completion, is being arranged by the Entertainment Committee of the Philadelphia Committee of Arrangements.

It is most broad in its appeal; not only will it afford diversion and social relaxation to the fifteen to twenty thousand delegates who will attend the Congress, but it will give them educational and professional contact.

Besides the Sesquicentennial International Exposition, there will be more events than enough to keep the delegates busy during the hours the Congress is not in actual session.

For sight-seeing, Philadelphia is exceptionally endowed. As the birthplace of the nation, it has a wealth of historic interest, especially if the visitor be an American of patriotic instincts and a student of the history of his country. He will avail himself of the chance to view the Liberty Bell, Independence Hall, the Betsy Ross house, Benjamin Franklin's grave, Carpenters' Hall, the meeting place of the first Continental Congress, historic Germantown, Valley Forge, and other revered spots, almost without number. The Philadelphia hosts of the Dental Congress are completing plans for tours of all these historic spots during Congress week.

These historic places and relics hallowed by the nation are actually the focal points of the Sesquicentennial celebration which is being observed this summer. The Sesquicentennial signalizes the 150th anniversary of the signing of the Declaration of Independence. Many individual events of this all-summer historic celebration will include these spots in their ceremonies and, as the events will be in full course in August, the Dental Congress delegates will find diversion in these.

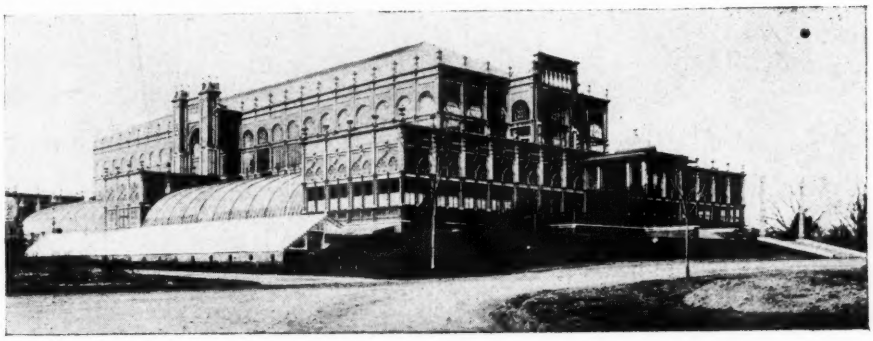
President Coolidge will open the Dental Congress, and will, during his

stay in the city for that purpose, participate in events identified with the historic anniversary.

An important excursion which has been arranged for the visitors is the trip to Valley Forge, where, in the winter of 1777-78, the Continental Army, under General Washington, endured rigor and privation, when the war of Revolution was at its lowest ebb.

The road runs through twenty miles of beautiful country, everywhere

Betsy Ross House, birthplace of the "Stars and Stripes."



Horticultural Hall in Fairmount Park. In Horticultural Hall, another relic of the Centennial Exposition, is one of the finest collections of tropical plants in the Temperate Zones.

replete with historic association. Sight-seeing busses and automobiles will convey the dentists who elect to take the trip.

A stopping place on this trip will be the fine gothic chapel erected on Valley Forge's hallowed ground by patriotic societies and citizens in tribute to the heroic Continental Army. Ladies of the societies which undertake the maintenance of this architecturally and patriotically remarkable temple will serve luncheon to the dental visitors in a grove adjoining the chapel.

Another trip will be to Kennett Square, an historical spot famed in song and story, the journey to which lies through the immortalized country described in Bayard Taylor's *The Story of Kennett.* The objective point on

this trip will be the wonderfully laid-out estate of Pierre S. duPont, famed for its botanical gardens and landscape effects. Here the visitors will be Mr. duPont's guests at tea.

There will be a trip to Atlantic City, the famous "playground of the world," which is an hour's ride from Philadelphia. The special train will leave in the afternoon and return to Philadelphia that night, so the delegates may attend the Congress session the next day. Arrangements will be made for stop-over by those who desire, and there will be trips to the resort after the adjournment of the Congress. Atlantic City, the most cosmopolitan resort in the world, frequently accommodates more than half a million guests.

Drives through Fairmount Park, one of the largest public pleasure grounds in the world, will also be included in the entertainment itinerary.

In Fairmount Park one finds not only the beauty of nature in its primeval state combined with the most ambitious efforts of the landscape

Congress Hall. Washington was inaugurated in this building for his second term as President on March 4, 1793, and John Adams for his first term as President on March 4, 1797.

engineer, but also numerous historic spots. The latter feature is mainly given by the estates of families prominent in the Colonial and Revolutionary periods, which estates formed the nucleus of the park. There are, for instance; "Lansdowne," the seat of John Penn, Colonial Governor of Pennsylvania; "Mount Pleasant," once the home of Benedict Arnold, purchased by him for his wife, Peggy Shippen, and confiscated by the state when Arnold's treason became known; "Lemon Hill," the country house of Robert Morris, financier of the Revolution, within whose walls Washington, Franklin, Jefferson and Lafayette were frequent guests; "Belmont," the revolutionary country seat of Judge Richard Peters, patriot and Secretary of War; "Woodford," in whose ancient garden are the famous "Franklin trees"; "Strawberry Mansion," "Rockland," "Ormiston," "Sweetbriar," "Edgeley"—each the former estate of a family dating back to early times. All are now parts of the park and each mansion is open to the public, some containing relics of their original owners and mementoes of the nation's his-

tory. There are other relics, such as William Penn's house, the poet Tom Moore's cottage; General Grant's battlefield cabin, etc. Penn Treaty Park, where William Penn made his treaty with the Indians for the purchase of Pennsylvania, and Bartram's Gardens, the estate of the celebrated naturalist, are in other parts of the city and are also public property.

There will be personally conducted trips to the Sesquicentennial Exposition and many other trips.

Philadelphia contains many collections of art and scientific material. The new Museum of Art, erected at the entrance to Fairmount Park, will be formally opened during the Sesquicentennial and will contain an exceptional display of painting and sculpture, the gift of public spirited citizens. Other collections are in the Academy of the Fine Arts, the Pennsylvania Museum in Fairmount Park, the Johnson collection, etc.

Shopping tours to the fine stores of which Philadelphia boasts will be arranged, as well as other entertainment, of a social and entertaining nature, especially for the ladies.

Interior of Stadium, looking from upper tier of seats from southern end of stadium showing area where athletic contests and pageantry will be displayed, features of the Sesqui-Centennial Exposition opening in Philadelphia, June 1, and closing December 1, 1926.

There will be formal entertainment each night in honor of the delegates. The American Dental Association, the Pennsylvania State Dental Association and the dental professional bodies of the city, as well as the collegiate faculties, fraternities and other organizations, will vie in entertaining the visitors.

On Tuesday night of the Congress week, the Congress banquet will be held in the ballroom of the Bellevue-Stratford Hotel. A reception by the officers of the Congress will be held later in the night.

Receptions to officers of the Congress and of the Federation Dentaire Internationale and to the distinguished practitioners are being arranged.

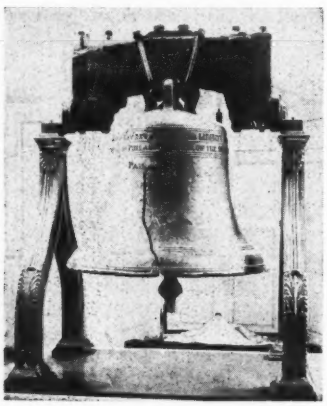
The program of entertainment is being planned so that events will in some instances be simultaneous; this provides for entertainment of all delegates when lack of hall space or accommodations limit the attendance at any one event.

The Committee of Entertainment is headed by Dr. J. Clarence Salvas,

as chairman, and comprises Mrs. Matthew H. Cryer, and Drs. John M. Fogg, J. C. Curry, Herbert Parcher, Jr., and Agnew Irwin.

There will be no dearth of entertainment, it can be perceived, with the preparations this committee is making.

Its companion committee, that of Hotels and Accommodations, again sounds a warning to those who are contemplating attendance at the International Congress to make early reservation of accommodations. The hotel



Liberty Bell. Independence Hall is the mecca for thousands of visitors each year, all intent upon viewing the priceless Liberty Bell. The Bell is now placed in a special case and can be removed easily in case of fire. On July 8, 1835, while being tolled in memory of Chief Justice John Marshall, the Bell was cracked. It has never been rung since that date.

Independence Hall and its historic environs. The old State House, better known as Independence Hall, comprises a main building with two arcades, connecting it with two two-story buildings, and was built during the years 1732 and 1741, after the plans of Andrew Hamilton. The Legislature first met in the building in October, 1736, Andrew Hamilton being elected Speaker and Benjamin Franklin, clerk. The Constitution of the United States was adopted here in 1787.

space is limited, owing to the presence of other conventions in Philadelphia at the same time.

It is of the utmost importance that every dentist who has the slightest intention of attending the Congress should communicate at once with the management of one of the Philadelphia hotels, or other housing agency, and make reservations.

The officers of the Dental Congress draw attention to the fact that only those holding cards of membership in the Congress will be admitted to its sessions.

Members of the American Dental Association are, by virtue of their membership in good standing in that body, active members of the Congress. The rules of the Congress provide that any national dental body may join on behalf of its members, paying a fee of $1 per head. Associate membership, with admission to the Congress, is provided for members of the medical profession and of other scientific professions, on payment of $10 each.

Dental students can be admitted to the sessions on the payment of a $5 fee, covering the entire Congress, and on being vouched for by the dean of some other officer of the dental school which they attend. Visitors to the Congress who are not eligible for membership, such as the families of members, may gain admission to its sessions upon payment of $5 each. Dental practitioners in this country not members of the American Dental Association are not eligible to admission to the sessions.

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## Southwestern Society of Orthodontists

### Annual Meeting, August 4 to 7, Houston, Texas

Three months ago tentative plans of the 1926 Houston meeting of our society and a boat trip to the Orthodontic Congress in New York, were outlined to you. Owing to the fact that as good accommodations and rates have been offered by the Mallory Line sailing from Galveston, a slight change has been made.

The meeting of the Southwestern Society will begin at 9:00 A.M., August 4, Headquarters: Rice Hotel, Houston, and continue through August 7. On Saturday, August 8, we will leave Galveston 3 P.M., aboard S. S. San Jacinto for New York. All main deck cabins, reservations for eighty-six persons, have been retained until May 15. Over fifty have signified their positive intentions to join the party. In order to secure the best accommodations and to assist Dr. Arnold in arranging many details, it will be necessary for each one making the trip to forward a deposit of $20.00. You may purchase round trip tickets over any railroad to Houston, Mallory line to New York, however, and return to your home over any railroad route you may desire. Your deposit will be returned to you in full on the sailing date. When forwarding remittance to me, please state the total rates for round trip quoted you by your local agent. We have secured a special rate, and, if it has not been quoted to you, it will give me ample time to secure a correction.

Reservations have been made for you in Houston and New York. Entertainment has been arranged for the Ladies. Our program, which will equal the past meetings, will soon be ready to mail to you. Arrangements are also being made to have such Southern Society members as desire to join our party at Key West (the only stop made between Galveston and New York).

A number of our Dental friends have inquired about the trip, and, as the date fits in nicely for those attending the Seventh International Dental Congress at Philadelphia, we will be glad to have as many as can make the trip with us. Kindly explain details to them and forward their names and required deposit to me. "First come, first served," as the number of reservations are limited. The round trip rate does not greatly exceed the round trip rail route, and is less, when meals and berth for five days on the boat are considered.

It may appear that these reservations are made greatly in advance. We assure you that such an arrangement has been found necessary. Should some condition arise previous to July which would prevent your making the trip, we assure you there will be little, if any, difficulty in filling your reservation and returning your deposit to you.

Best time of year for Boat Trip Entertainment—something doing for everyone every minute. A trip you cannot afford to miss.

A prompt reply helps us to help you; final completion of plans and program depends on you. Sixteen additional upper deck rooms, available at $10.00 additional charge per person, rated round trip: from Kansas City $126.77, Omaha $141.11, Tulsa and Oklahoma City $126.77, Waco $123.26, Chicago $137.00, Detroit $136.76, Nashville and Montgomery via Houston $129.00, Nashville and Montgomery via Key West $95.00 or less, Amarillo $141.00, Denver $173.00, Dallas and Ft. Worth $121.00. If by auto, boat rate from Galveston to New York $63.00 per person, auto freight rate $1.38 per hundred pounds.

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**Important Notice**

Because of the First International Orthodontic Congress to be held in New York City, August 16 to 20, and of the Seventh International Dental Congress to be held in Philadelphia, August 21 to 27, the Twenty-fifth Annual Meeting of the American Society of Orthodontists will be limited to one business session, which will convene on Monday morning, August 16, at 9:30 A.M., at the Hotel Commodore, New York City, for the transaction of all business that ordinarily is cared for during an annual session of the Society. Members are urged to be prompt in attendance and to bring before this, the only session, any matters that must receive the action of the Society.—William C. Fisher, 501 Fifth Ave., New York City; Walter H. Ellis, Secy., 33 Gates Circle, Buffalo, N. Y.